

TOYOTA

2F ENGINE

REPAIR MANUAL

Aug., 1980

TOYOTA MOTOR CORPORATION

Pub. No. 36104E

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INTRODUCTION

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GENERAL REPAIR INSTRUCTIONS

1. Use fender, seat and floor covers to keep the car clean and prevent damage.
2. During disassembly, keep parts in order to facilitate reassembly.
3. Before performing electrical work, disconnect the cable from the battery terminal.
4. Always replace cotter pins, gaskets and O rings with new ones.
5. When necessary, use a sealer on gaskets to prevent leaks.
6. Carefully observe all specifications for bolt tightening torques. Always use a torque wrench.
7. Use genuine Toyota parts.
8. When replacing fuses, be sure the new fuse is the correct amperage. **DO NOT** exceed the fuse amp rating or use one of a lower rating.
9. If the vehicle is to be jacked up only at the front or rear end, be sure to block the wheels in order to ensure safety.
10. After the vehicle is jacked up, be sure to support it on stands. It is extremely dangerous to do any work on the vehicle raised on a jack alone, even for a small job that can be finished quickly.
11. Use of a special service tool (SST) may be required, depending on the nature of the repair. Be sure to use SST where specified and follow the proper work procedure. A list of SST can be found at the back of this manual.

ABBREVIATIONS USED IN TOYOTA REPAIR MANUALS

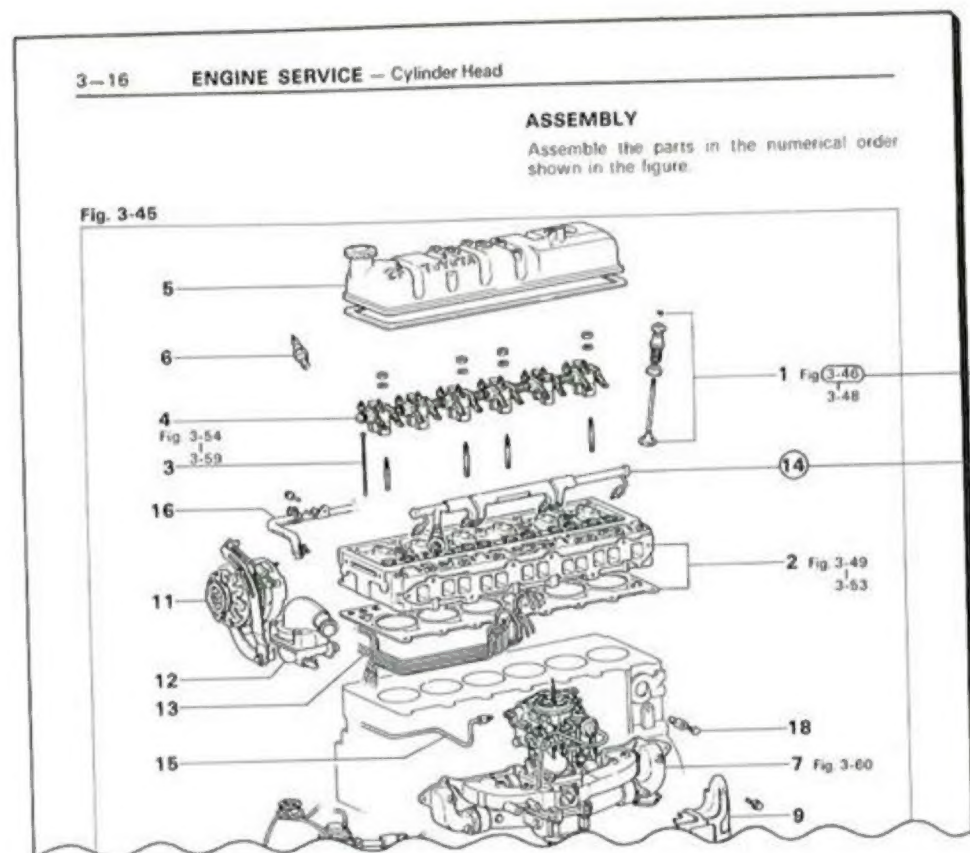
For convenience, the following abbreviations are used in Toyota repair manuals.

Abbreviation	Term	Abbreviation	Term
A/T	Automatic Transmission	O/S	Oversize
BDC	Bottom Dead Center	RH	Right-hand
BTDC	Before Top Dead Center	RHD	Right-hand Drive
EX	Exhaust	SST	Special Service Tool
IN	Intake	STD	Standard
LH	Left-hand	T	Tightening Torque
LHD	Left-hand Drive	TDC	Top Dead Center
MP	Multipurpose	U/S	Undersize
M/T	Manual Transmission	W/	With
OPT	Option	W/O	Without

HOW TO USE THIS MANUAL

1. OVERVIEW ILLUSTRATION

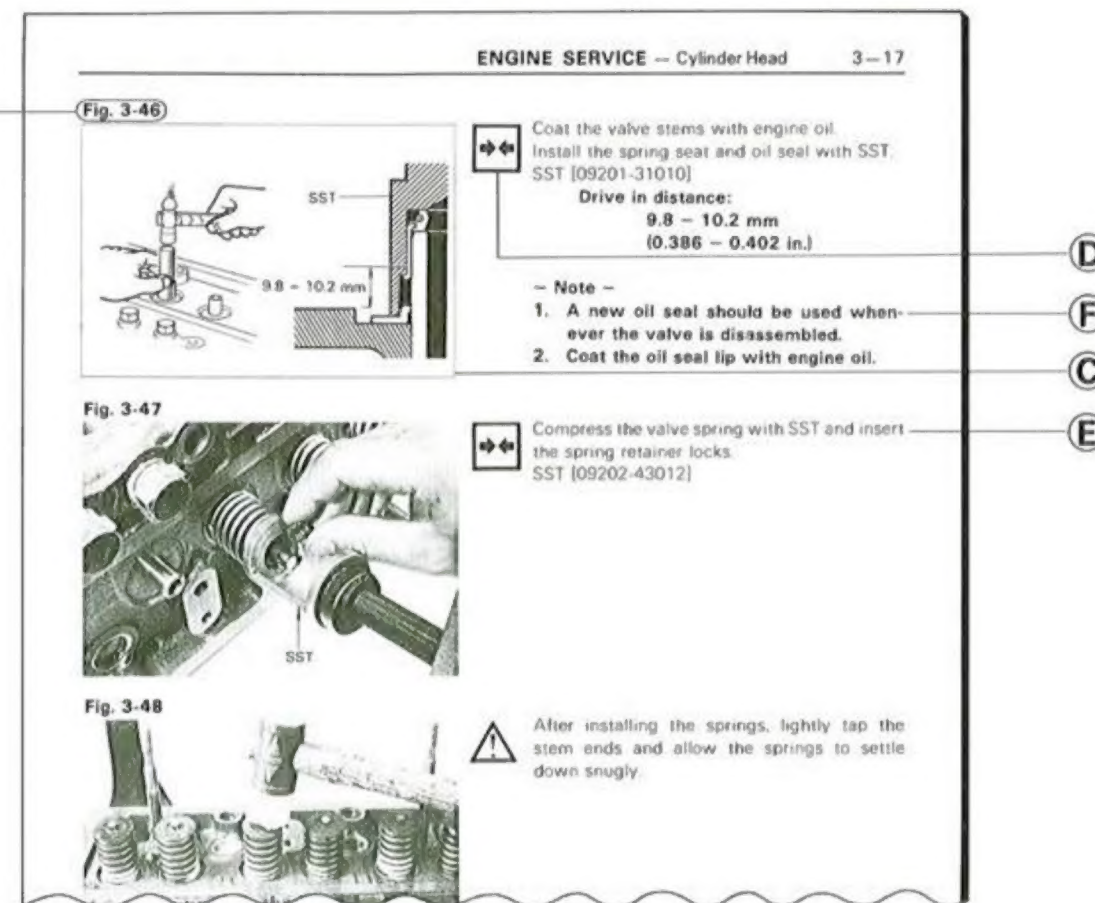
Many service operations begin with an overview illustration as a general guide.



- (A)** : The bold numbers indicate the order in which the work is to be done.
- (B)** : The figure numbers refer you to more detailed instructions and specifications.

2. ILLUSTRATED INSTRUCTIONS

All important steps in every service job are illustrated. Obvious steps are omitted to save space. Experienced technicians may only need to glance at the overview illustration and/or specifications.



- (C)** : The pictures give basic information on what to do in each step.
- (D)** : A symbol is often used to explain the action required.
- (E)** : The text explains how to perform the step.
- (F)** : Specifications, Notes and Cautions are given in bold type so you won't miss them.

SYMBOLS

The following symbols have been adopted for simplicity and quick recognition.



REMOVE or DISASSEMBLE



INSTALL or ASSEMBLE



INSPECT



MEASURE



TIGHTEN



CLEAN



IMPORTANT

ENGINE TUNE-UP

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ENGINE TUNE-UP ITEMS

ITEM		REMARKS	
1	DRIVE BELT TENSION		
	(General destinations)		
	Deflection with 10 kg (22 lb) force		
	Fan — Alternator		
	N.S.W. & Victoria states	13 — 15 mm	0.51 — 0.59 in.
	Other Australian states	7 — 10 mm	0.28 — 0.39 in.
	ex. Australia		
	New belt	7 — 9 mm	0.28 — 0.35 in.
	Used belt	9 — 12 mm	0.35 — 0.47 in.
	Fan — Air pump		
2	BATTERY		
	Specific gravity	1.25 — 1.27	
		[when fully charged at 20°C (68°F)]	
	Electrolyte level	Correct level	
	ENGINE OIL		
	Oil level check	F line	
	Oil replenishment	USA	API service SE or better
		ECE	API service SD, SE or better
		Others	API service SC, SD, SE or better
	Oil capacity	Dry fill	8.0 liters 8.5 US qt 7.0 Imp. qt
3		Drain & refill	
		w/ oil filter change	7.8 liters 8.2 US qt 6.9 Imp. qt
		w/o oil filter change	7.0 liters 7.4 US qt 6.2 Imp. qt
	Oil filter replacement	SST [09228-44010]	
	COOLING SYSTEM		
	Coolant level	Full line	
	Coolant quality, Leakage		
	Radiator cap valve opening pressure		
		STD	0.75 — 1.05 kg/cm ²
			(10.7 — 14.9 psi)
4		Limit	0.6 kg/cm ² 8.5 psi
	Coolant capacity w/ heater or air conditioner		
	FJ40, 43, 45 series	16.0 liters	16.9 US qt 14.1 Imp. qt
	FJ60 series	16.5 liters	17.4 US qt 14.5 Imp. qt
	FA series	25.0 liters	26.4 US qt 22.0 Imp. qt
	AIR CLEANER		
	Clean element		
	Oil capacity (Oil bath type)	Correct level	

ITEM		REMARKS	
6	HOT AIR INTAKE		
	Operational check		
	SPARK PLUGS		
	Visual check, Cleaning		
	Gap	0.8 mm	0.031 in.
	HIGH TENSION CORD		
	Less than 25 kΩ per cord		
	DISTRIBUTOR		
	Distributor cap		
	Air gap (USA)	0.2 — 0.4 mm	0.008 — 0.016 in.
7	Rubbing block gap (except USA)	0.3 mm	0.012 in.
	Governor advancer, Vacuum advancer		
	IGNITION TIMING		
	Dwell angle (except USA)	41°	
	Ignition timing	7° BTDC/Max. 950 rpm	
	VALVE CLEARANCE	HOT	
	Intake	0.20 mm	0.008 in.
	Exhaust	0.35 mm	0.014 in.
	CARBURETOR		
	Choke, Choke breaker, Choke opener		
8	Float level, Acceleration pump		
	IDLE SPEED ADJUSTMENT (USA)		
	Idle speed	650 rpm	
	IDLE SPEED & IDLE MIXTURE ADJUSTMENT		
	(except USA)	Idle speed	650 rpm
	Idle mixture speed	690 rpm	
	FAST IDLE SPEED ADJUSTMENT		
	Fast idle speed	USA	1,800 rpm
		N.S.W. & Victoria states	(w/EGR and EVAP systems OFF and vacuum advancer OFF)
			1,800 rpm
9		(w/EGR & EVAP systems OFF)	
			1,800 rpm
	THROTTLE POSITIONER		
	Throttle positioner setting speed		
	N.S.W. & Victoria states	1,200 rpm (w/EGR & EVAP systems OFF)	
	Others	1,000 rpm	
	COMPRESSION PRESSURE	at 250 rpm	
	STD	10.5 kg/cm ²	149 psi
	Limit	8.0 kg/cm ²	114 psi
	Pressure difference between each cylinder		Less than 1.0 kg/cm ² (14 psi)

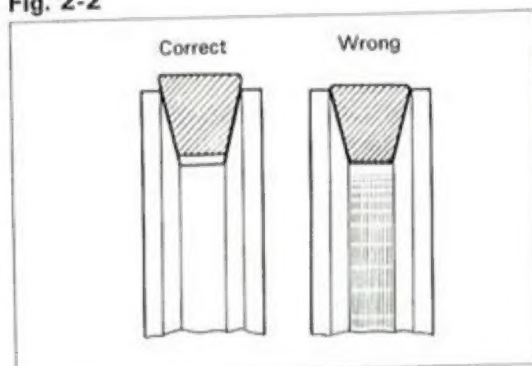
Fig. 2-1

**DRIVE BELT****VISUAL CHECK**

Check for:

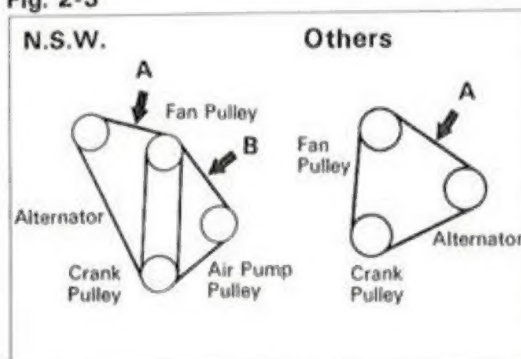
1. Cracks, deterioration, stretching or wear.
2. Adherence of oil or grease.

Fig. 2-2



3. Improper belt-to-pulley contact.

Fig. 2-3

**CHECK & ADJUST BELT TENSION****General destinations**

With 10 kg (22 lb) of force, press on the belts at the points indicated in the figure. The belts should deflect the amount specified.

Drive belt deflection

	N.S.W. & Victoria	Other Australian states	except Australia
A mm (in.)	13 - 15 (0.51 - 0.59)	7 - 10 (0.28 - 0.39)	New 7 - 9 (0.28 - 0.35)
			Used 9 - 12 (0.35 - 0.47)
B mm (in.)	7 - 10 (0.28 - 0.39)	—	—

**USA**

Using a Borroughs belt tension gauge BT-33-73F, adjust as follows:

Drive belt tension:**Air con.**

New belt	100 - 150 lbs
Used belt	60 - 80 lbs

Others

New belt	120 - 170 lbs
Used belt	80 - 120 lbs

Fig. 2-4

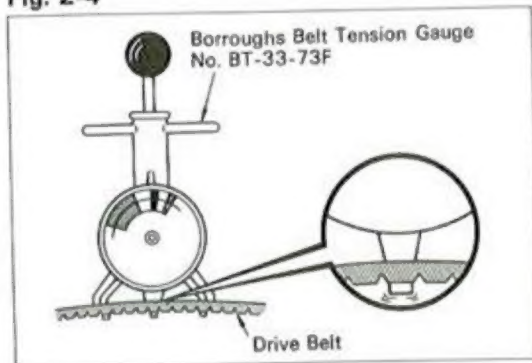
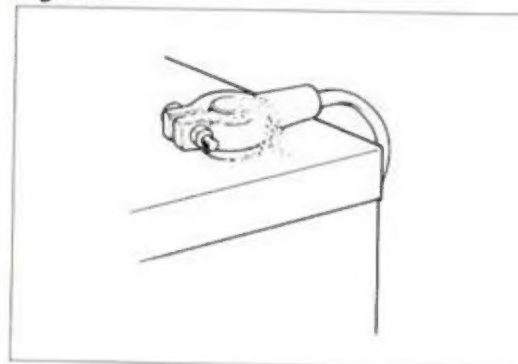


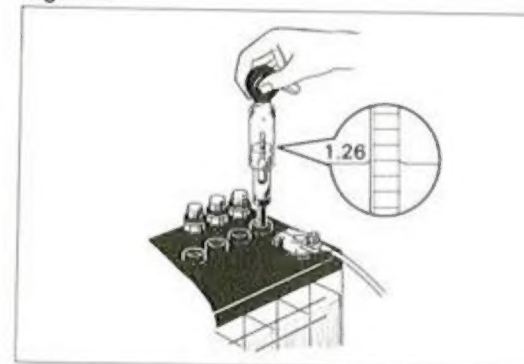
Fig. 2-5

**BATTERY****VISUAL CHECK**

Check for:

1. Rusted battery support.
2. Loose terminal connections.
3. Rusted or deteriorated terminals.
4. Damaged or leaking battery.

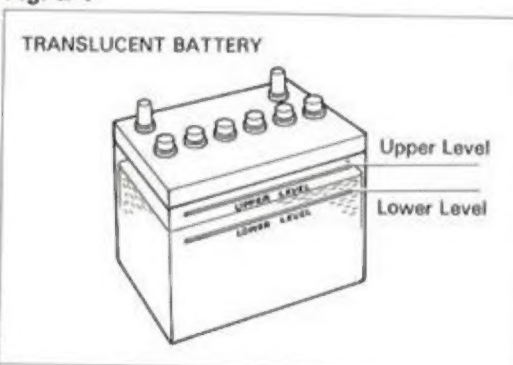
Fig. 2-6

**MEASURE SPECIFIC GRAVITY**

1. Check the specific gravity of the electrolyte with a hydrometer.

Specific gravity [when fully charged at 20°C (68°F)]:
1.25 - 1.27

Fig. 2-7



2. Check the electrolyte quantity of each cell. If insufficient, refill with distilled water.

Fig. 2-8

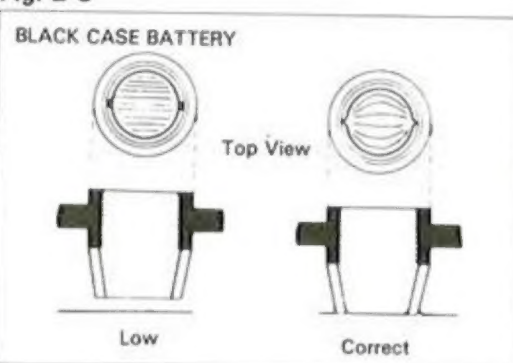
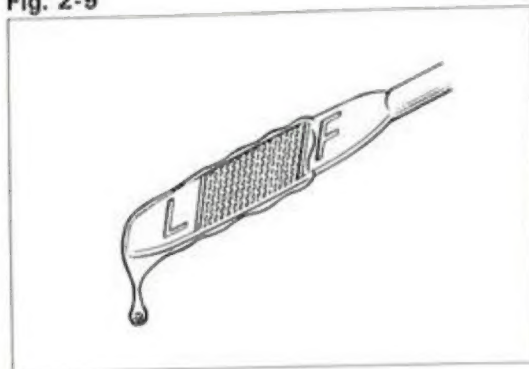


Fig. 2-9



ENGINE OIL



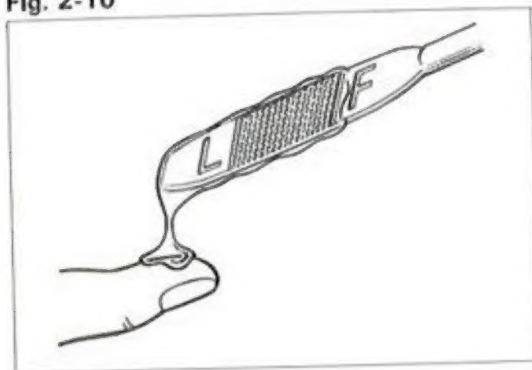
CHECK OIL LEVEL

The oil level should be between the L and F marks. If low, check for leakage and add oil up to the F mark.

Use the engine oil indicated below.

- USA — API service SE or better
- ECE — API service SD, SE or better
- Others — API service SC, SD, SE or better

Fig. 2-10



CHECK OIL QUALITY



Check for:

1. Deterioration.
2. Entry of water.
3. Discoloration or thinning.

Fig. 2-11



REPLACE OIL FILTER



1. Remove the oil filter with SST.
2. Install a new filter and tighten it firmly by hand.



— Note —

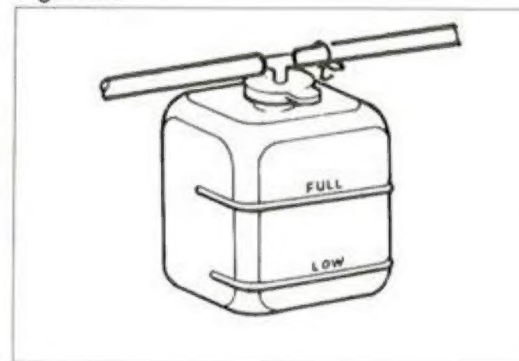
Do not tighten with SST or a wrench.

Fig. 2-12



3. Start the engine and check for oil leakage.
4. Stop the engine and recheck the oil level.

Fig. 2-13



COOLING SYSTEM

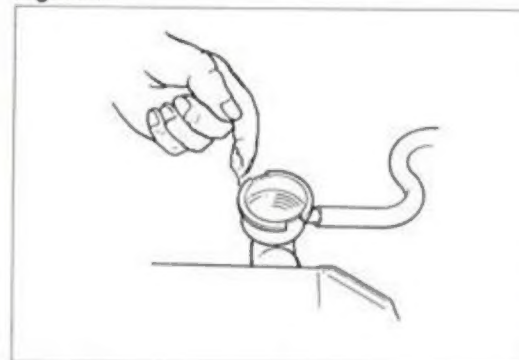
CHECK COOLANT LEVEL

If low, fill reservoir to FULL line.

— Note —

To maintain freeze protection, use a recommended anti-freeze.

Fig. 2-14

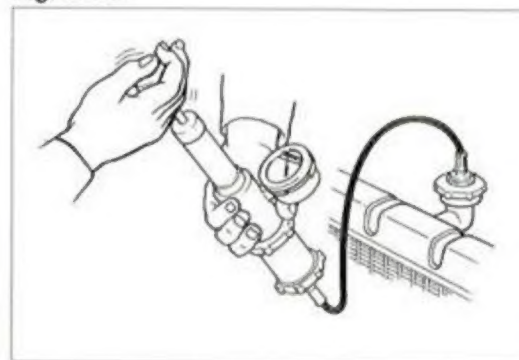


CHECK COOLANT QUALITY

Check for:

1. Coolant cleanliness.
2. Rust or scale deposits around the radiator cap and filler neck.
3. Entry of oil.

Fig. 2-15

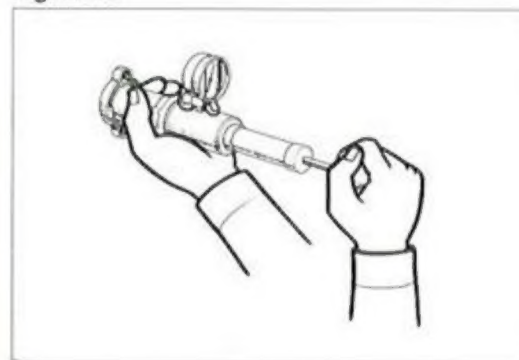


CHECK COOLING SYSTEM PARTS

Check for:

1. Damaged or deteriorated radiator and water hoses.
2. Loose hose clamps.
3. Damaged or corroded radiator core.
4. Leakage from the water pump, radiator core or loose water drain cock.

Fig. 2-16



5. Faulty operation of radiator cap. Inspect the spring tension and seating condition of the radiator cap vacuum valves. If the valve opens at a pressure below specification or is otherwise defective, replace the radiator cap.

Valve opening pressure:

STD	0.75 – 1.05 kg/cm ² (10.7 – 14.9 psi)
Limit	0.6 kg/cm ² (8.5 psi)

Fig. 2-17



Fig. 2-18

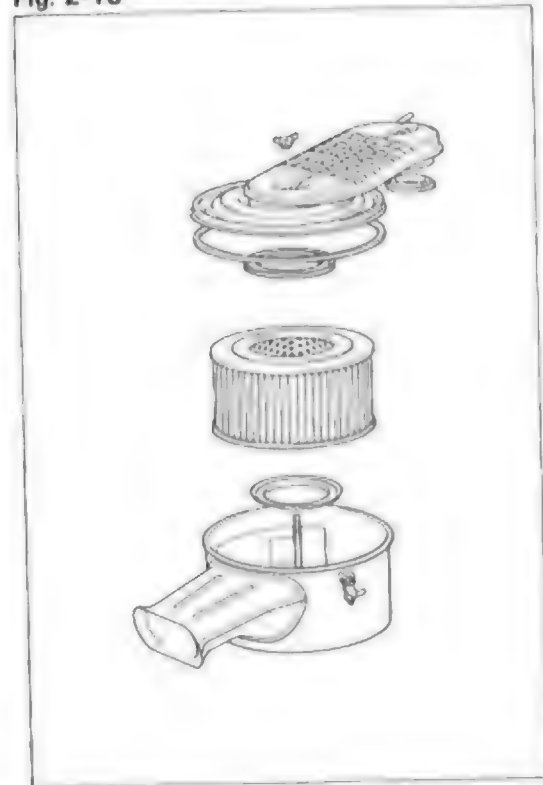
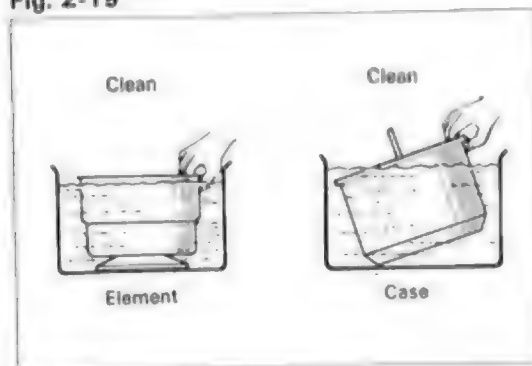


Fig. 2-19

**AIR CLEANER****[Paper Element Type]****CLEAN ELEMENT**

1. Remove the air cleaner.

— Note —

Use care to prevent dirt or other foreign matter from entering into the carburetor.

2. Remove the element and blow compressed air from inside.
3. Replace the element with a new one if torn or excessively dirty

VISUAL CHECK

Check for:

1. Damaged, worn or deteriorated gaskets.
2. Damaged or worn seal washer.

INSTALL AIR CLEANER

1. Install the gaskets.
2. Finger tighten the brackets.
3. After installing the element, tighten the air cleaner cap with the clips.
4. Tighten the wing nut and brackets.

[Oil Bath Type]**CLEAN ELEMENT**

1. Remove the air cleaner and element.
2. Clean the element and case with kerosene and dry them thoroughly

Fig. 2-20

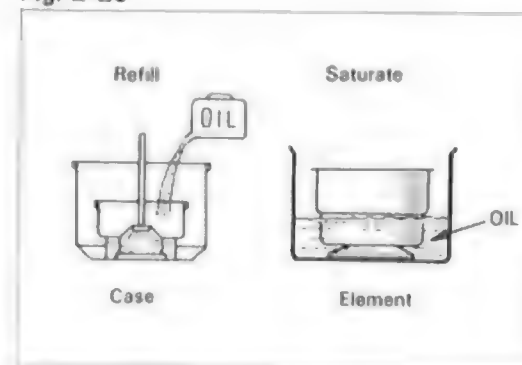


Fig. 2-21

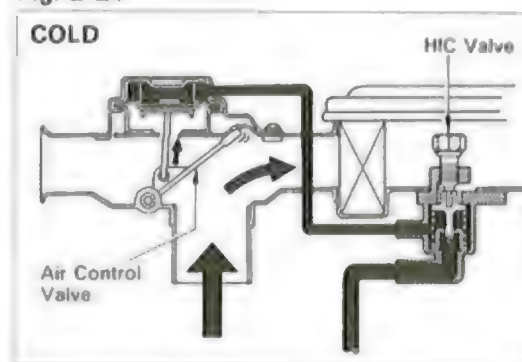


Fig. 2-22

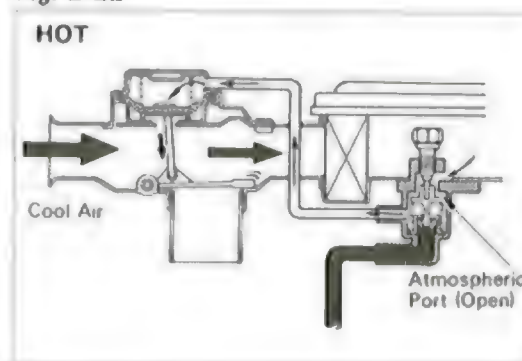
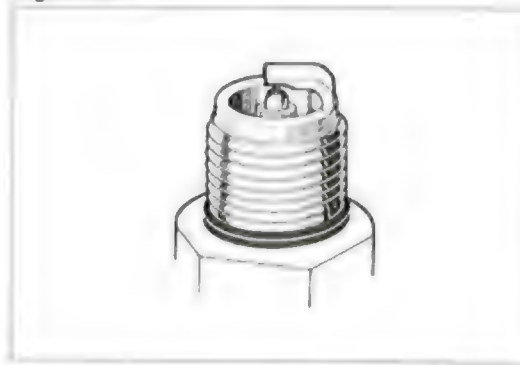


Fig. 2-23

**INSTALL AIR CLEANER**

1. Refill the case up to the indicated level with clean engine oil.
2. Saturate the element with clean engine oil
3. Install the cap and element.
4. Tighten the air cleaner on the air cleaner support.

**HOT AIR INTAKE
(USA, N.S.W. & ECE FJ series)****INSPECTION**

1. Remove the air cleaner cap.
2. Cool the HIC valve by blowing compressed air on it.
3. Check that the air control valve closes the cool air passage at idle.

4. Reinstall the air cleaner cap and warm up the engine.
5. Check that the air control valve opens the cool air passage at idle.

SPARK PLUGS**VISUAL CHECK**

Check for:

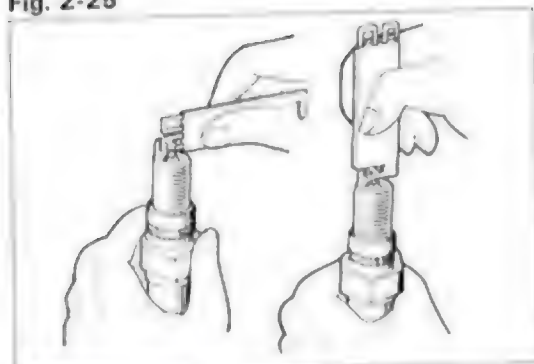
1. Cracks or other damage on the threads and insulator.
2. Electrode wear
3. Damaged or deteriorated gaskets.
4. Burnt electrode or excess carbon deposits.

Fig. 2-24

**CLEAN SPARK PLUGS**

1. Do not use the spark plug cleaner any longer than necessary
2. Thoroughly blow off the cleaning compound and carbon on the threads with compressed air
3. Clean off the dirt from the outer surface of insulator and threads

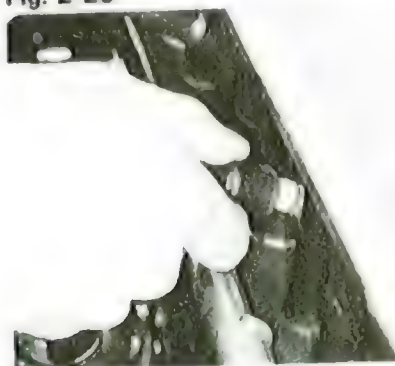
Fig. 2-25

**ADJUST SPARK PLUG GAP**

Check each plug gap with a spark plug gap gauge. If necessary, adjust by bending the protruding (outer) electrode.

Spark plug gap: 0.8 mm
(0.031 in.)

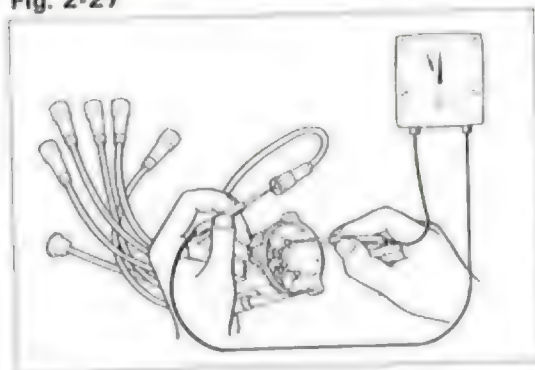
Fig. 2-26

**HIGH TENSION CORD****CHECK RESISTANCE**

— Note —

When pulling the cord off the spark plug, always grip the end of the cord.

Fig. 2-27

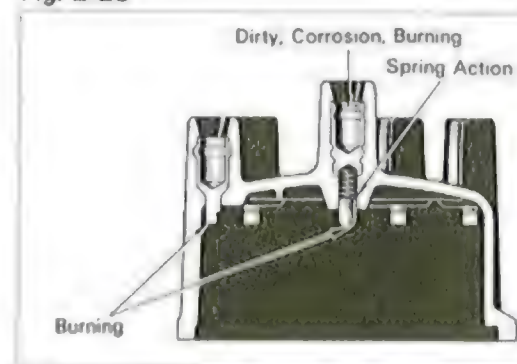


Check the cord resistance

Resistance:

Less than 25 kΩ per cord

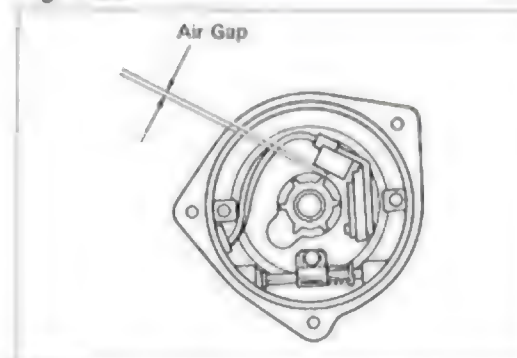
Fig. 2-28

**DISTRIBUTOR****CHECK DISTRIBUTOR CAP**

Clean the distributor cap and check the cap and rotor for:

1. Cracks, damage, corrosion, burning or dirty cord hole.
2. Burnt electrode terminal
3. Weak center piece spring action

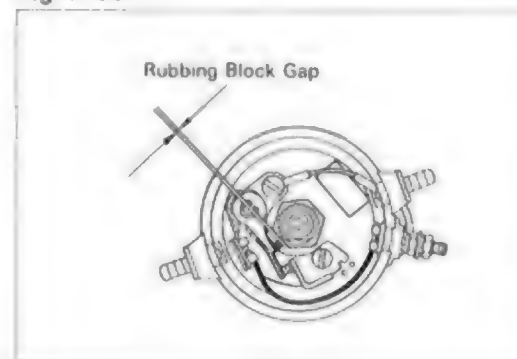
Fig. 2-29

**ADJUST GAP**

1. Adjust the air gap. (USA)

Air gap: 0.2 – 0.4 mm
(0.008 – 0.016 in.)

Fig. 2-30



2. Adjust the rubbing block gap. (Others)

Rubbing block gap:
0.3 mm
(0.012 in.)

Fig. 2-31

**CHECK GOVERNOR OPERATION**

1. Turn the rotor clockwise and release it. The rotor should return quickly.
2. Check the rotor for looseness.

Fig. 2-32

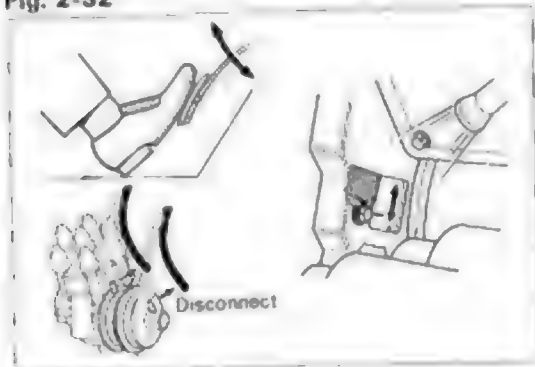


Fig. 2-33

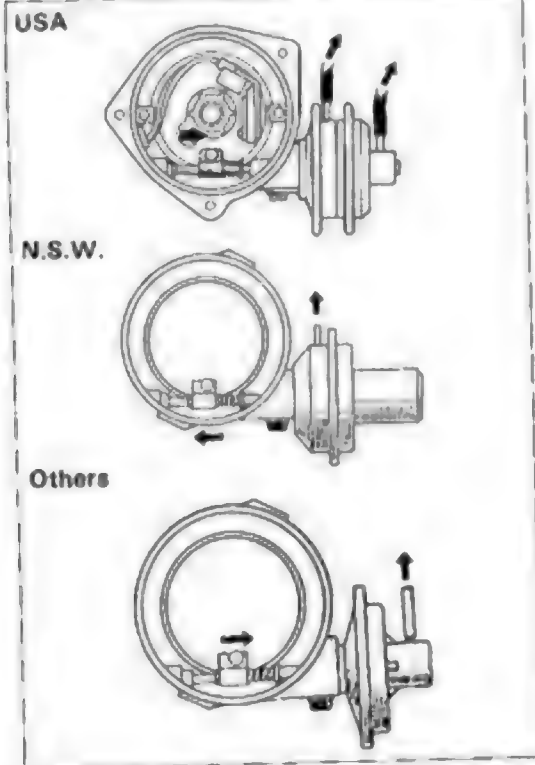
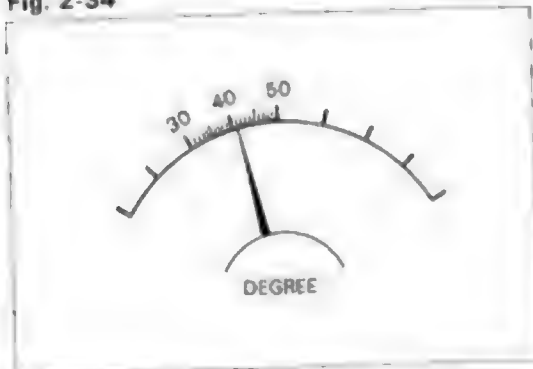


Fig. 2-34



- 3 Start the engine and disconnect the vacuum hoses from the distributor. The timing mark should vary with the engine rpm



CHECK VACUUM ADVANCER OPERATION

Apply vacuum to the diaphragm and check that the vacuum advancer moves in accordance with the vacuum

IGNITION TIMING



CHECK DWELL ANGLE (except USA)

Using a dwell angle tester, check the dwell angle at idle speed before adjusting the ignition timing

Dwell angle: 41°

If the angle does not meet specification, adjust the rubbing block gap as follows:

- More than 42° —> Decrease the gap.
- Less than 40° —> Increase the gap.

Fig. 2-35

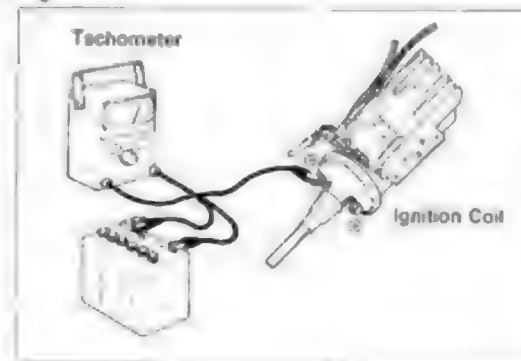


Fig. 2-36

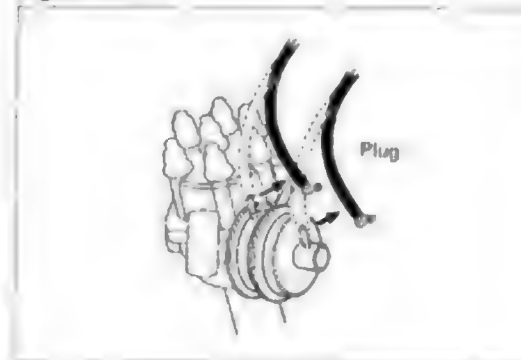


Fig. 2-37

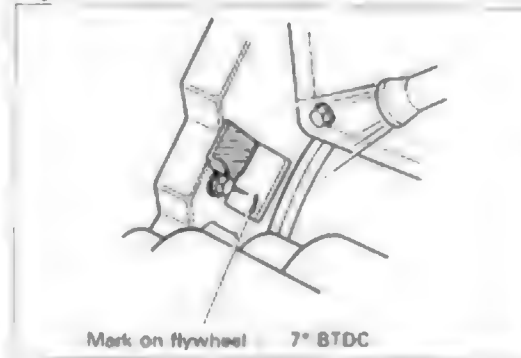
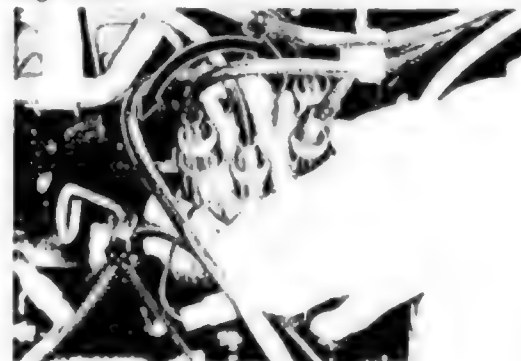


Fig. 2-38



CHECK IGNITION TIMING

- 1 Connect a tachometer and timing light

— Note —

1. Do not keep the ignition switch ON for more than 10 minutes if the engine will not start.
2. As some tachometers are not compatible with this ignition system, it is recommended that you consult with the manufacturer.
3. NEVER allow the ignition coil terminals to touch ground as it could result in damage to the igniter and/or ignition coil.
4. Do not disconnect the battery when the engine is running.
5. Make sure that the igniter is properly grounded to the body.

- 2 Warm up the engine
- 3 Disconnect the vacuum hoses from the distributor and plug the ends of them



- 4 Check the ignition timing with the engine idling

Ignition timing:
7° BTDC/Max. 950 rpm
(w/ Vacuum advance cut)



- 5 If necessary, loosen the distributor bolt and turn the distributor to align the marks
- 6 Recheck the timing after tightening the distributor

Fig. 2-39



Fig. 2-40

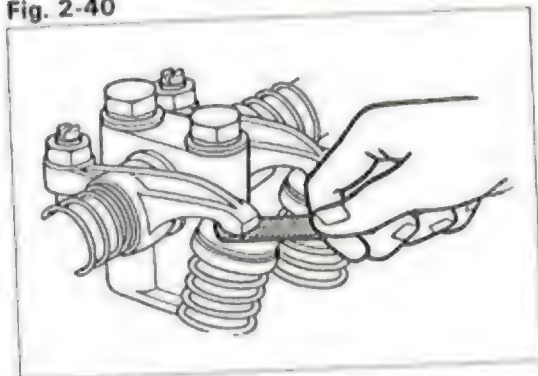
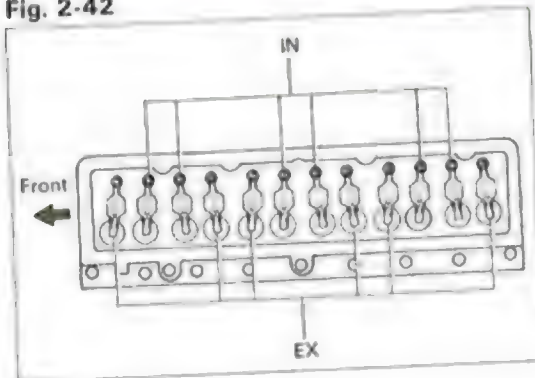


Fig. 2-41



Fig. 2-42



VALVE CLEARANCE

ADJUSTMENT

1. Warm up the engine to normal operating temperature.
2. Stop the engine and retighten the cylinder head bolts, the rocker support bolts and nuts

Tightening torque:

Cylinder head bolts
11.5 – 13.5 kg-m
(84 – 97 ft-lb)

Rocker support bolts and nuts
10 mm bolt 3.0 – 4.5 kg-m
(22 – 32 ft-lb)
8 mm bolt 2.0 – 3.0 kg-m
(15 – 21 ft-lb)

3. Adjust the valve clearance.
(1) Set the engine at idle speed, and check the valve clearance. Adjust if necessary.

Valve clearance:

Intake 0.20 mm
(0.008 in.)
Exhaust 0.35 mm
(0.014 in.)

- (2) Retighten the lock nuts securely after adjustment.

- (3) Recheck the valve clearance.



Fig. 2-43

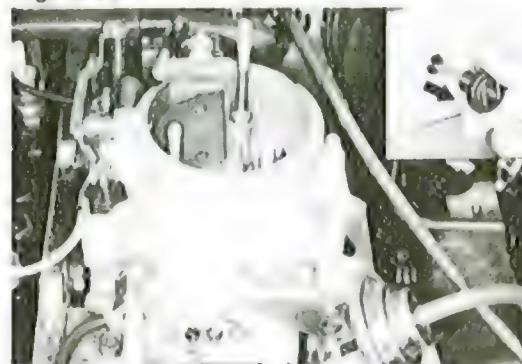


Fig. 2-44

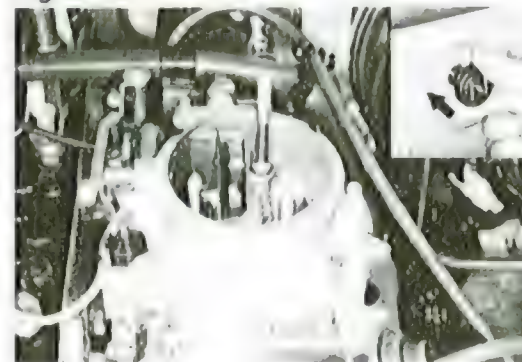


Fig. 2-45

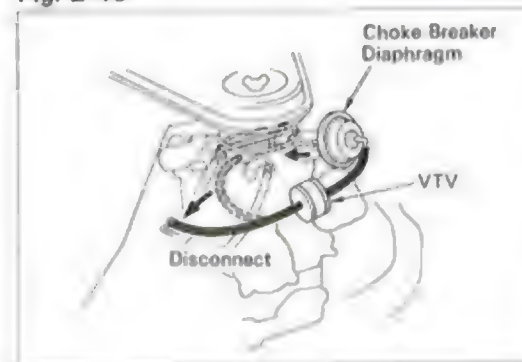
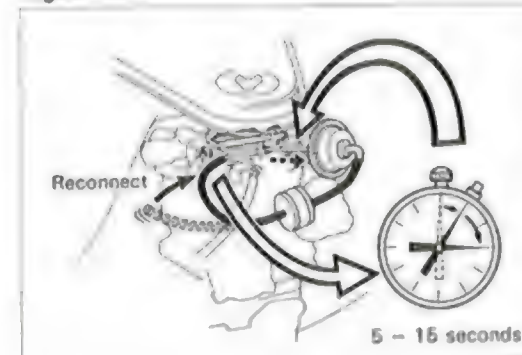


Fig. 2-46



CARBURETOR



CHOKE

1. Pull out the choke knob all the way and check to see that the choke valve is fully closed



2. Check to see that the choke valve is fully open when the choke knob has been returned



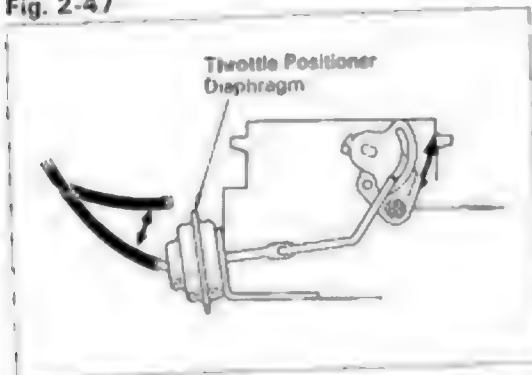
CHOKE BREAKER (USA)

1. Start the engine
2. Disconnect the vacuum hose between the carburetor and the VTV at the carburetor side.
3. Check that the choke breaker linkage returns quickly by spring tension.



4. Reconnect the hose
5. Check that the choke breaker linkage is pulled into the diaphragm within 5 – 15 seconds after reconnecting the hose

Fig. 2-47



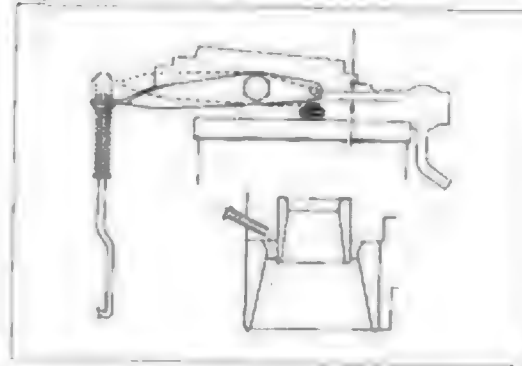
CHOKE BREAKER (FJ except General and USA)

1. Start the engine.
2. Disconnect the hose from the throttle positioner diaphragm and check that the choke linkage returns.
3. Reconnect the hose to the throttle positioner diaphragm and check that the choke linkage is pulled by the diaphragm.

— Note —

The choke breaker system utilizes the throttle positioner diaphragm.

Fig. 2-51



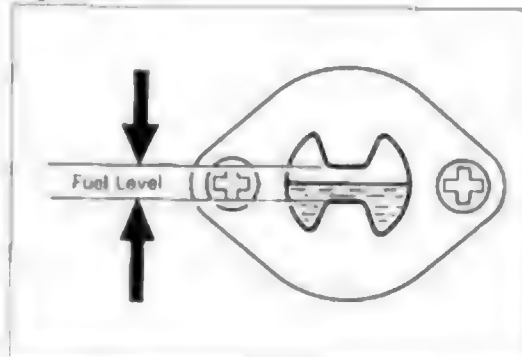
CHECK ACCELERATION PUMP

1. Check the acceleration pump operation. Gasoline should shoot out with force from the jet when the throttle valve is opened.
2. Check the throttle valve opening. The throttle valve should be fully open when the accelerator pedal is fully depressed.

Acceleration pump stroke:

9.5 mm
(0.374 in.)

Fig. 2-52



IDLE SPEED ADJUSTMENT (USA)

1. Check the following items beforehand:
 - (1) Air cleaner installed
 - (2) Normal operating coolant temperature
 - (3) Choke fully open
 - (4) All accessories switched off
 - (5) All vacuum lines connected
 - (6) Ignition timing set correctly
 - (7) Transmission in neutral
 - (8) Fuel level should be about even with the correct level in the sight glass

Fig. 2-53

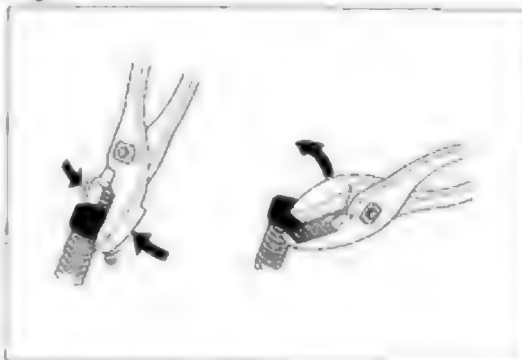
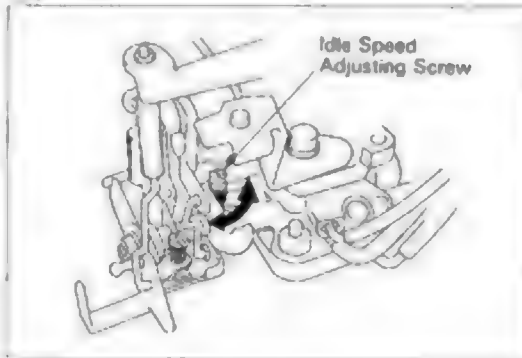


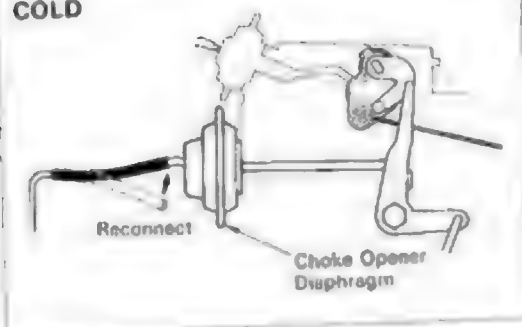
Fig. 2-54



2. Break the idle limiter cap on the idle speed adjusting screw, if one is installed.
3. Adjust the idle speed by turning the idle speed adjusting screw.
Idle speed: 650 rpm

Fig. 2-48

COLD



CHOKE OPENER (USA)

1. The coolant temperature should be below 5°C (41°F).
2. Start the engine and disconnect the hose from the choke opener diaphragm and reconnect it.
3. Check that the choke linkage does not move.

Fig. 2-49

HOT

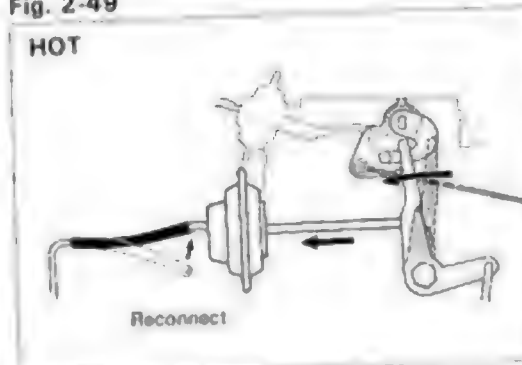
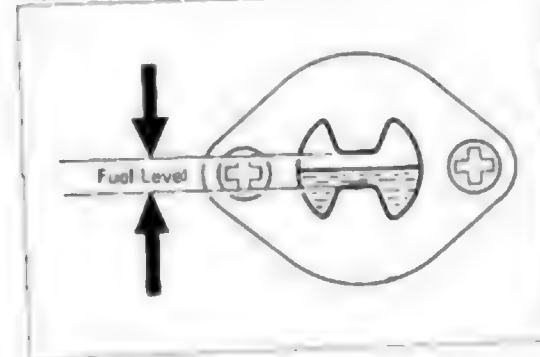


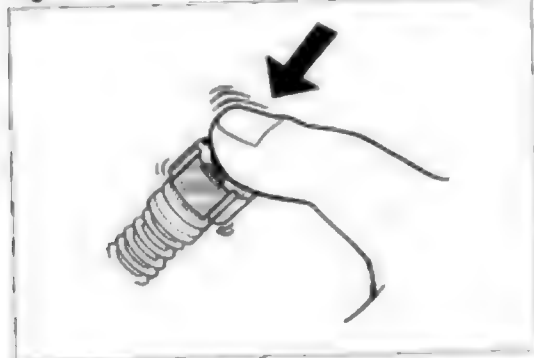
Fig. 2-50



CHECK FUEL LEVEL

Check the fuel level while the engine is idling.

Fig. 2-55



4. Install a new limiter cap on the idle speed adjusting screw, if one was installed.

Fig. 2-56

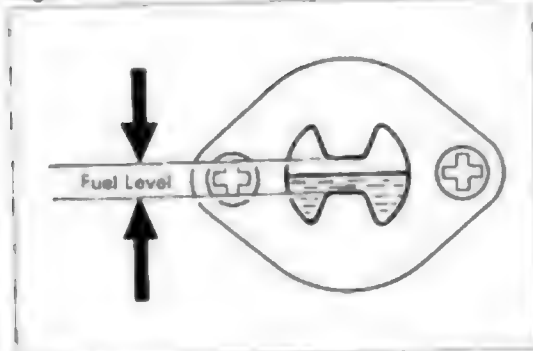
SEE
FUEL SYSTEM SECTION
Fig. 6-163 to 6-175

— Note —

For the idle mixture adjustment, the idle mixture adjusting screw is adjusted and plugged with a steel plug by the manufacturer.

If necessary, remove the plug and follow the procedure described in FUEL SYSTEM section.

Fig. 2-57



IDLE SPEED & IDLE MIXTURE ADJUSTMENT (except USA)

1. Check the following items beforehand
 - (1) Air cleaner installed
 - (2) Normal operating coolant temperature
 - (3) Choke fully open
 - (4) All accessories switched off
 - (5) All vacuum lines connected
 - (6) Ignition timing set correctly
 - (7) Transmission in neutral
 - (8) Fuel level should be about even with the correct level in the sight glass.



2. Break the idle limiter cap on the idle speed adjusting screw, if one is installed.

Fig. 2-58

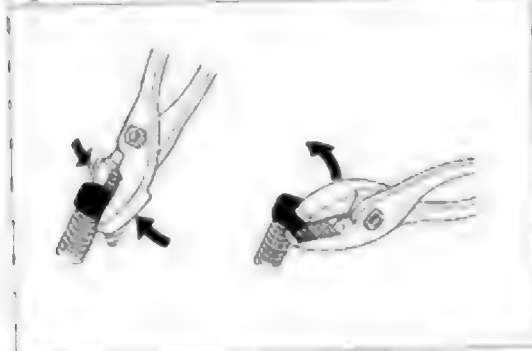
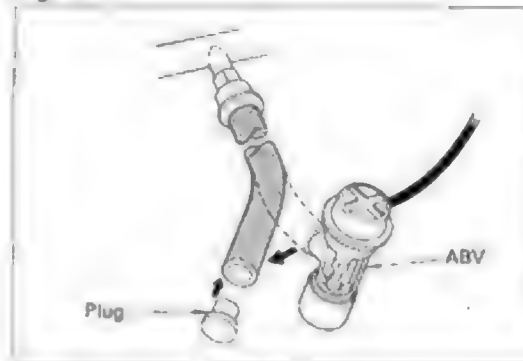
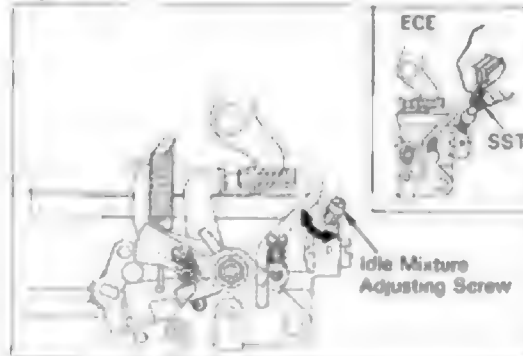


Fig. 2-59



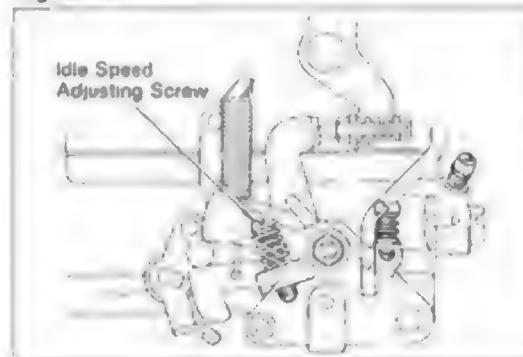
3. (N.S.W. & Victoria states)
Disconnect the air hose from the ABV and plug the hose end. (AI system OFF)

Fig. 2-60



4. Start the engine.
5. Set to the maximum speed by turning the idle mixture adjusting screw with SST (ECE) or a screwdriver (others).
SST [09243-00020]

Fig. 2-61

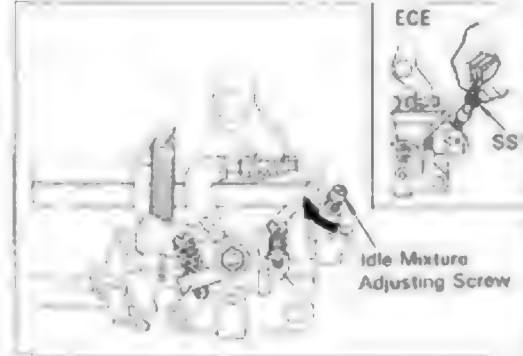


6. Set to the idle mixture speed by turning the idle speed adjusting screw.
Idle mixture speed: 690 rpm

— Note —

Before moving to the next step, continue adjustments 5 and 6 above, until the maximum speed will not rise any further no matter how much the IDLE MIXTURE ADJUSTING SCREW is adjusted.

Fig. 2-62



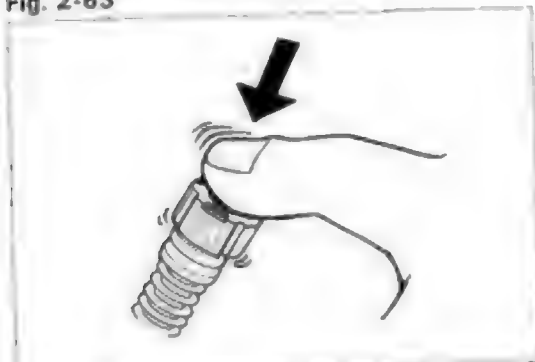
7. Set to the idle speed by screwing in the idle mixture adjusting screw with SST (ECE) or a screw driver (others).
SST [09243-00020]

Idle speed: 650 rpm

— Note —

This is the LEAN DROP METHOD for setting idle speed and mixture.

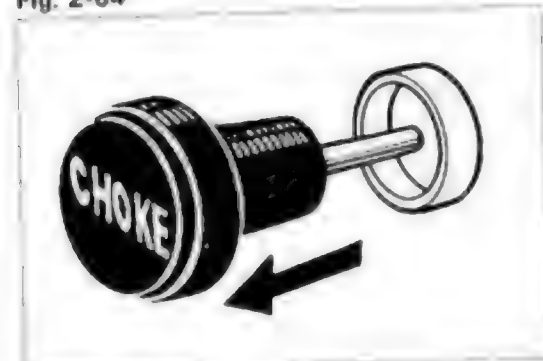
Fig. 2-63



8. (N.S.W. & Victoria states)
Reconnect the air hose to the ABV
9. Install a new limiter cap on the idle speed adjusting screw, if one was installed

— Note —
After completing adjustment, perform a road test to make certain engine performance has not changed.

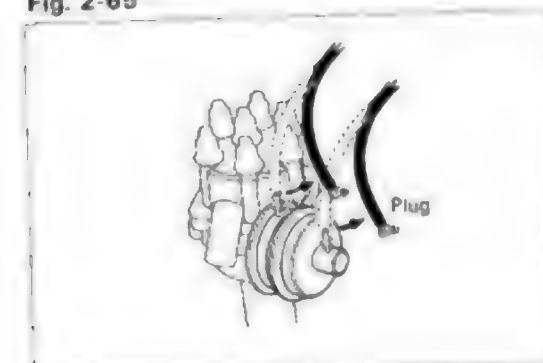
Fig. 2-64



FAST IDLE SPEED ADJUSTMENT (USA)

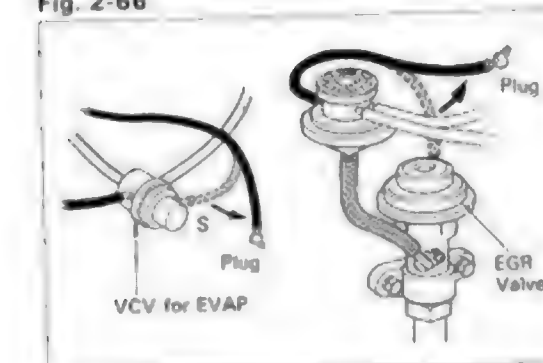
1. Warm up the engine and then stop it
2. Remove the air cleaner cover
3. Fully pull out the choke knob

Fig. 2-65



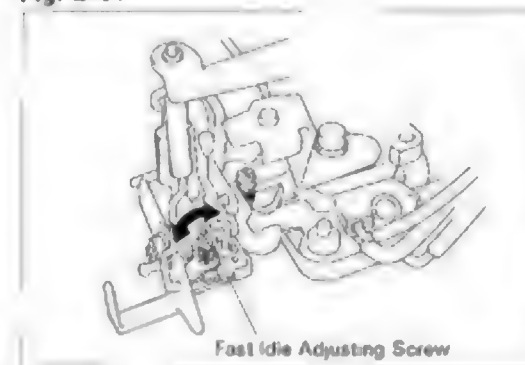
4. Disconnect the vacuum hoses from the distributor and plug the hose ends (Vacuum advancer OFF)

Fig. 2-66



5. Disconnect the vacuum hoses from port S of the VCV for EVAP, and EGR valve, and plug the hose ends (EVAP system and EGR system OFF)

Fig. 2-67



6. Adjust the fast idle speed by turning the fast idle adjusting screw

Fast idle speed: 1,800 rpm

7. When the choke knob is pushed in all the way, the engine speed should return to idle speed
8. Reinstall the air cleaner cover

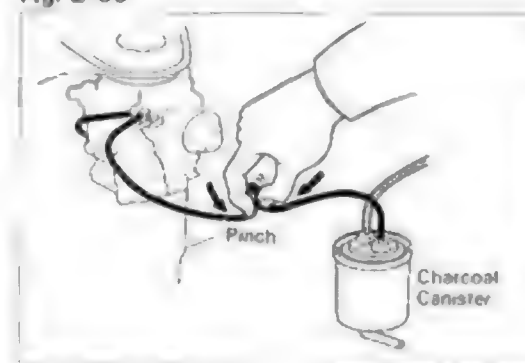
Fig. 2-68



FAST IDLE SPEED ADJUSTMENT (Others)

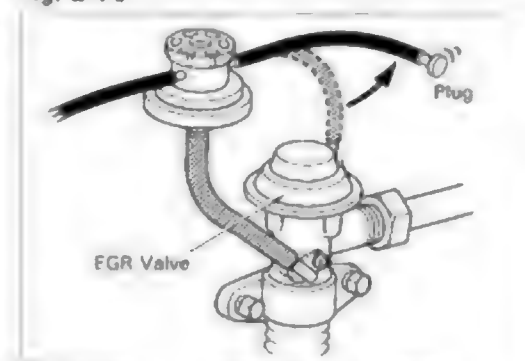
1. Warm up the engine and then stop it
2. Remove the air cleaner cover
3. Fully pull out the choke knob

Fig. 2-69



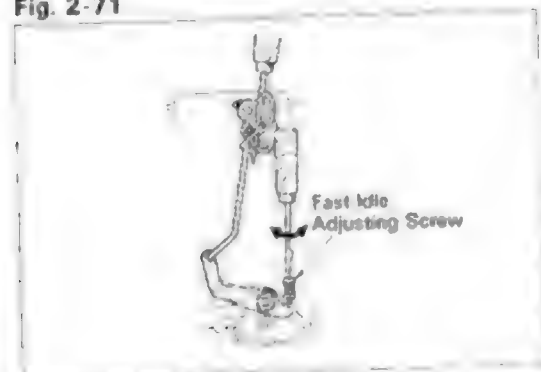
4. (N.S.W. & Victoria states)
(1) Pinch shut the vacuum hose to the charcoal canister. (EVAP system OFF)

Fig. 2-70



- (2) Disconnect the vacuum hose from the EGR valve and plug the hose end. (EGR system OFF)

Fig. 2-71



5. Open the choke valve with a screwdriver and start the engine
6. Adjust the fast idle speed by turning the fast idle adjusting screw
Fast idle speed: 1,800 rpm
7. When the choke knob is pushed in all the way, the engine speed should return to idle speed.

Fig. 2-72

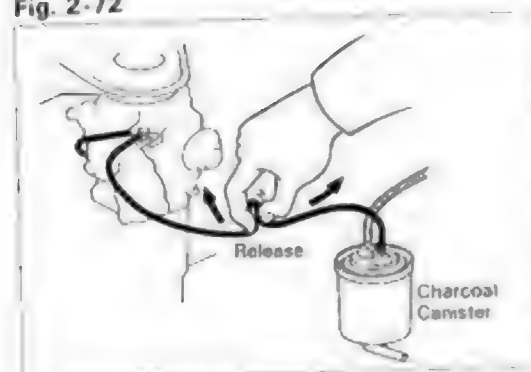
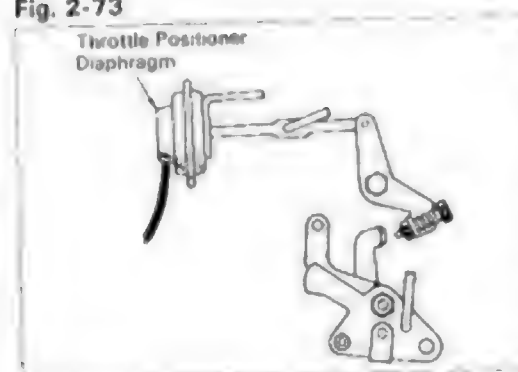


Fig. 2-73

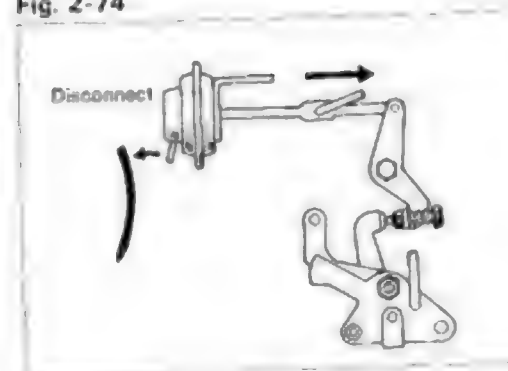


THROTTLE POSITIONER (Australia & ECE FJ series)

CHECK THROTTLE POSITIONER OPERATION

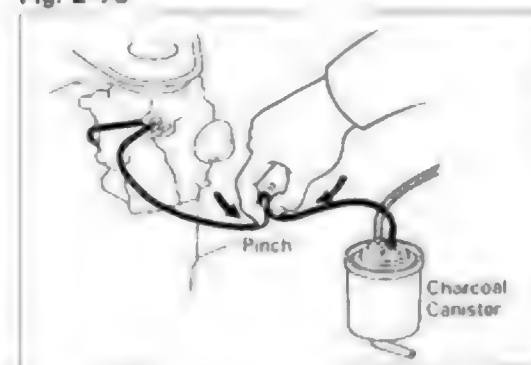
1. Warm up the engine
2. Check the idle speed and adjust if necessary
3. Check that the throttle positioner is released at idle

Fig. 2-74



4. Disconnect the vacuum hose from the throttle positioner diaphragm and plug the hose end.
5. Race the engine and then release the accelerator pedal
6. At this time, the throttle positioner adjusting screw should strike the throttle lever so that the engine runs faster than idle RPM. (Throttle positioner is set.)

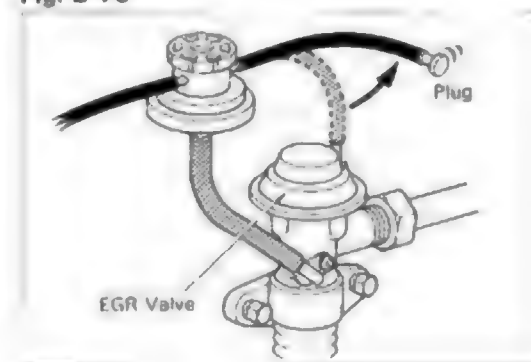
Fig. 2-75



CHECK THROTTLE POSITIONER SETTING SPEED

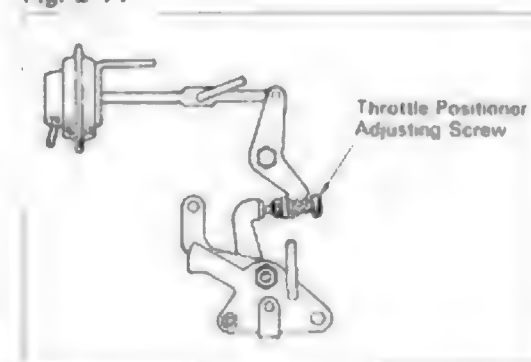
1. (N.S.W. & Victoria states)
(1) Pinch shut the vacuum hose to the charcoal canister. (EVAP system OFF)

Fig. 2-76



- (2) Disconnect the vacuum hose from the EGR valve and plug the hose end (EGR system OFF)

Fig. 2-77



2. With the throttle positioner set, check the engine speed

Throttle positioner setting speed:

N.S.W. & Victoria states

1,200 rpm

Others 1,000 rpm

3. If not at specified speed, adjust with the throttle positioner adjusting screw.
4. Release the pinched hose and reconnect the vacuum hoses to the proper locations.

Fig. 2-78



COMPRESSION PRESSURE

1. Warm up the engine
2. Remove all spark plugs.
3. Disconnect the high tension cord from the ignition coil to cut off the secondary circuit

Fig. 2-79



- 4 Insert a compression gauge into the spark plug hole and fully open the throttle valve. While cranking the engine, measure the compression pressure.

Compression pressure

(at 250 rpm):

STD More than 10.5 kg/cm²
(149 psi)

Limit 8.0 kg/cm²
(114 psi)

Pressure difference between each cylinder: Less than 1.0 kg/cm²
(14 psi)

— Note —

Always use a fully charged battery.

ENGINE SERVICE

	Page
CUTAWAY VIEW	3-2
CYLINDER HEAD	3-4
TIMING GEAR	3-21
CYLINDER BLOCK	3-32

CUTAWAY VIEW

Fig. 3-1

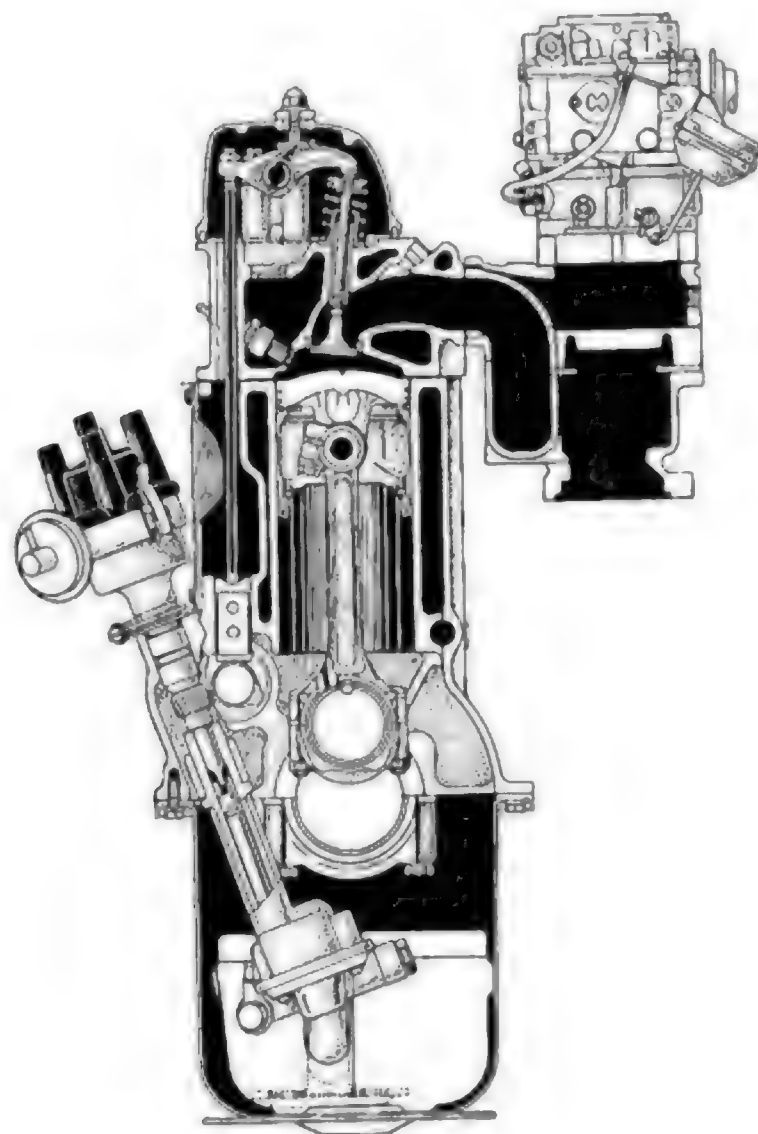
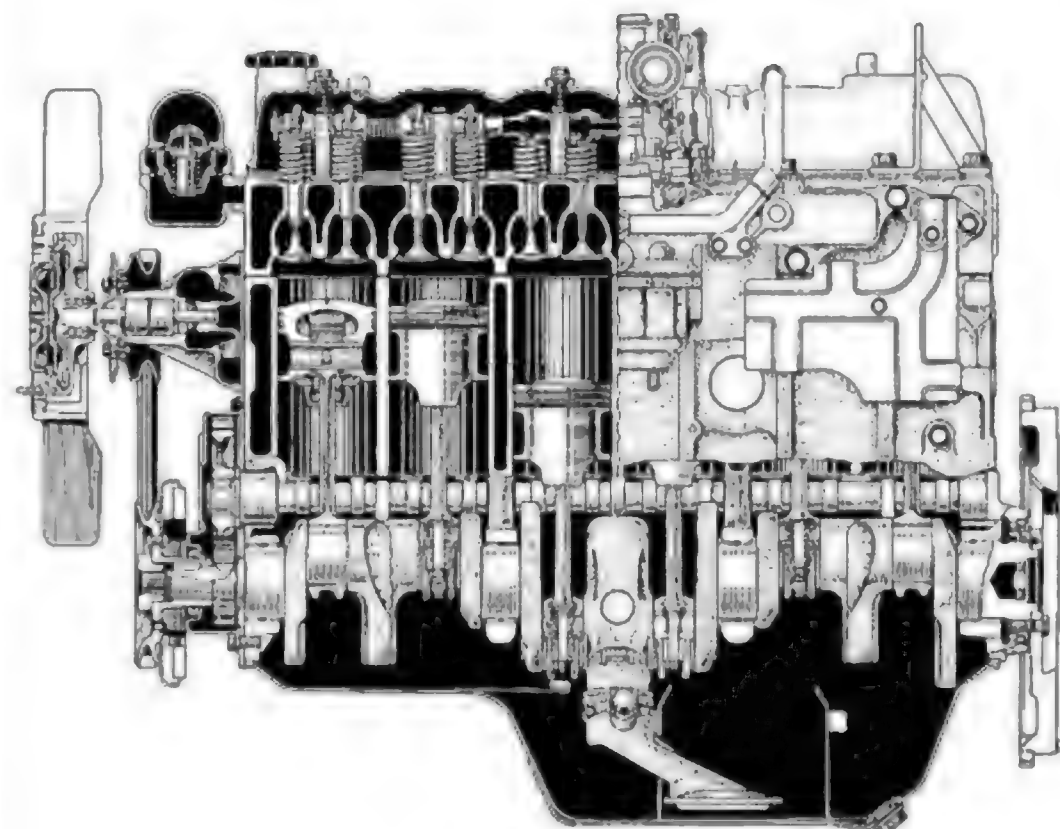


Fig. 3-2

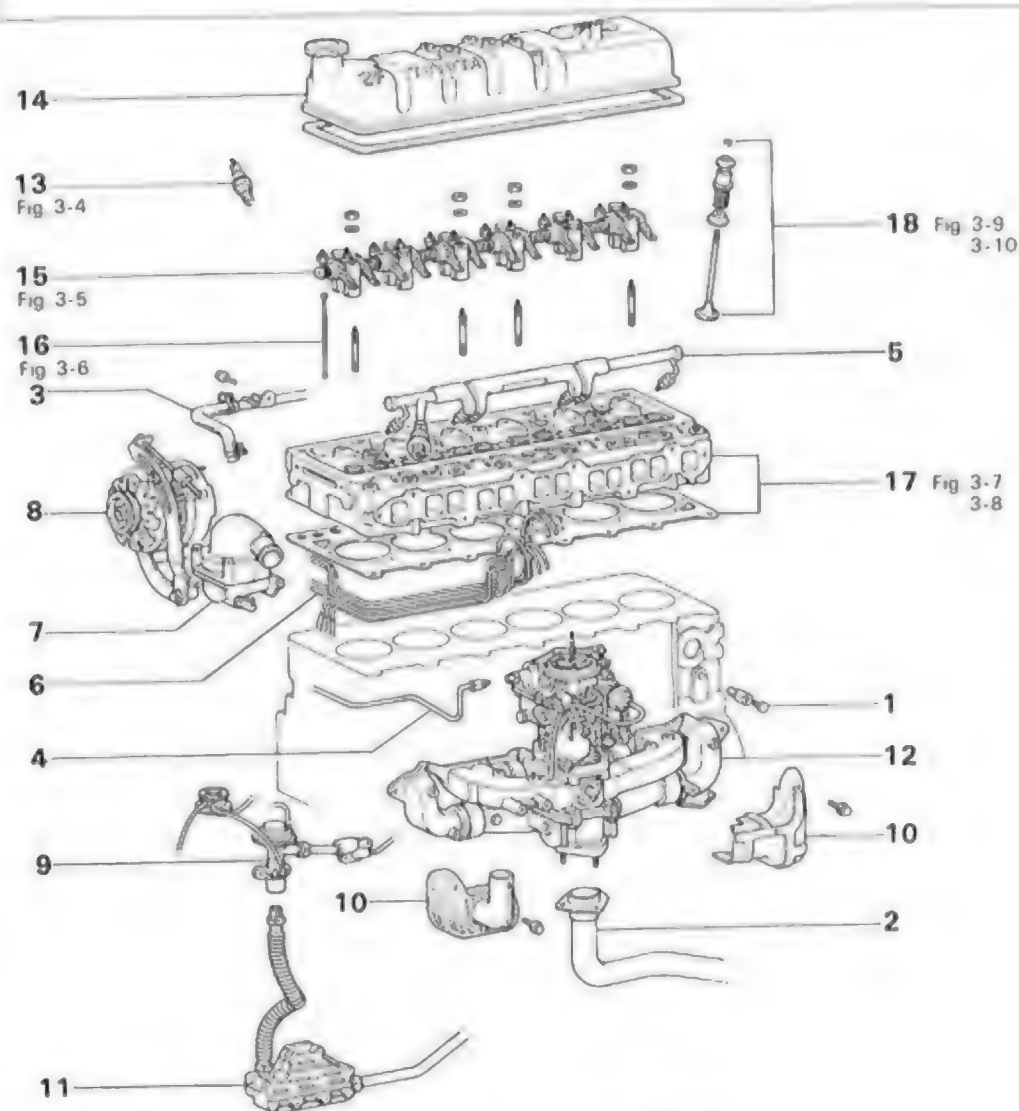


CYLINDER HEAD

DISASSEMBLY

Disassemble the parts in the numerical order shown in the figure.

Fig. 3-3



- | | |
|--------------------------|---------------------------|
| 1 Water Drain Plug | 10 Insulator |
| 2 Exhaust Pipe | 11 EGR Cooler |
| 3 Oil Cooler Hose | 12 Manifold |
| 4 Fuel Pipe | 13 Spark Plug |
| 5 Air Injection Manifold | 14 Cylinder Head Cover |
| 6 Vacuum Pipe | 15 Rocker Arm Assembly |
| 7 Water Outlet Housing | 16 Push Rod |
| 8 Alternator | 17 Cylinder Head & Gasket |
| 9 EGR Valve | 18 Valve & Spring |
- (5, 6, 8, 9, 11USA, N.S.W. & Victoria states FJ series)

Fig. 3-4



Remove the plug cords by carefully pulling on the rubber boots.

Fig. 3-5



Loosen each rocker support bolt a little at a time in the sequence shown in the figure.



Fig. 3-6



Keep the push rods in correct order.



Fig. 3-7



Loosen each cylinder head bolt a little at a time in the sequence shown in the figure.

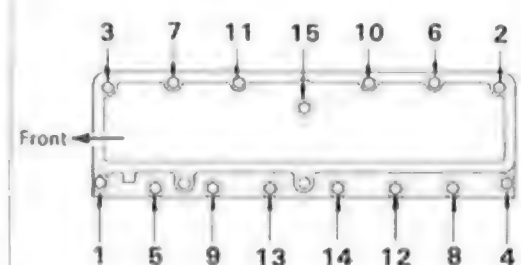
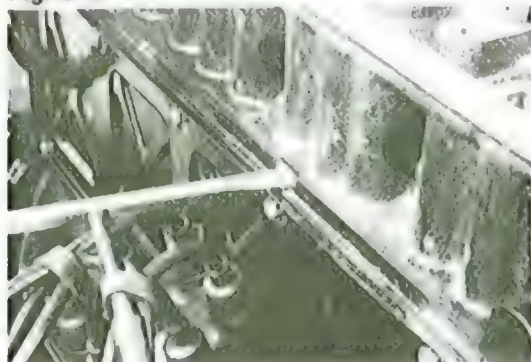
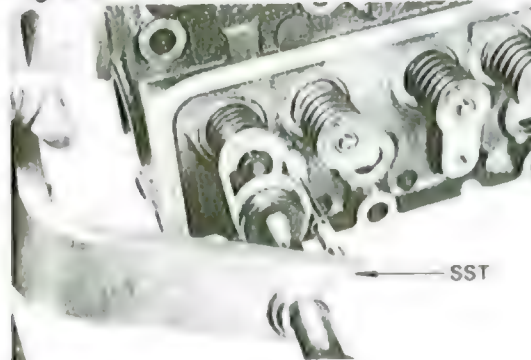


Fig. 3-8



If the cylinder head is difficult to lift off, pry with a screwdriver between the head and block

Fig. 3-9



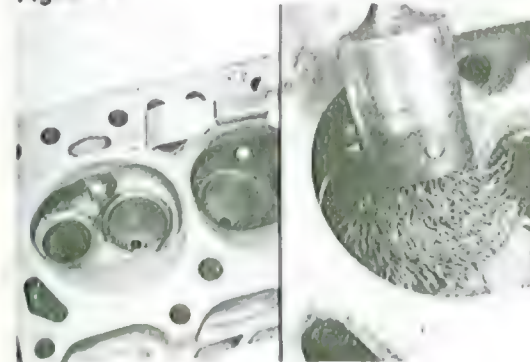
Remove the valves and springs with SST. SST [09202-43012]

Fig. 3-10



Arrange the valves in correct order.

Fig. 3-11

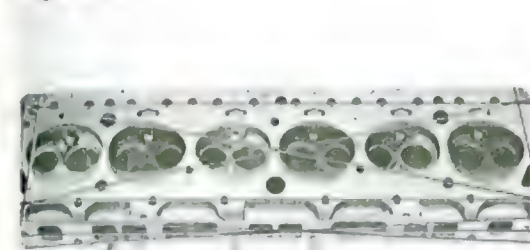


INSPECTION & REPAIR

Cylinder Head

1. Clean the combustion chamber and remove any gasket material from the manifold and head surface. Check the cylinder head for cracks or excessively burnt valve surfaces.

Fig. 3-12



2. Using a precision straight edge and thickness gauge, check the cylinder head under surface and manifold mounting surface for warpage.

Fig. 3-13



3. If warpage exceeds the limit, correct it by machining, or replace the head

Cylinder head surface warpage:

Limit 0.15 mm
(0.0059 in.)

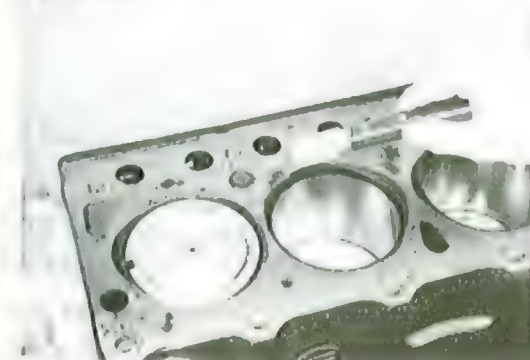
Manifold mounting surface warpage:

Limit 0.10 mm
(0.0039 in.)

Maximum reface:

Limit 0.20 mm
(0.0079 in.)

Fig. 3-14



4. Clean the cylinder block upper surface. Check the cylinder block. (Refer Fig. 3-107 to 3-111)

Fig. 3-15

**Valve & Guide**

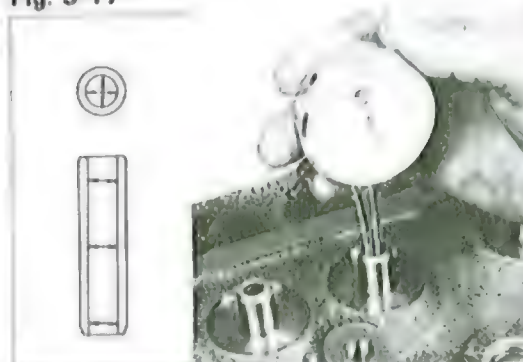
- 1 Clean and check the valves for wear, scores and bending.

Fig. 3-16



- 2 Check the valve stem-to-valve guide clearance
 - (1) Insert the valve stem into the guide
 - (2) Move the valve back and forth and check the clearance as shown in the figure.

Fig. 3-17



- 3 Measure the valve stem oil clearance.
 - (1) Measure the inside diameter of the valve guide at several places
Guide inside diameter:
 8.01 – 8.03 mm
 (0.3154 – 0.3161 in.)
 - (2) Measure the valve stem diameter.
Stem diameter:
 IN 7.970 – 7.985 mm
 (0.3138 – 0.3144 in.)
 EX 7.960 – 7.975 mm
 (0.3134 – 0.3140 in.)
 - (3) Calculate the valve stem oil clearance.
Stem oil clearance:
 STD IN 0.03 – 0.06 mm
 (0.0012 – 0.0024 in.)
 EX 0.04 – 0.07 mm
 (0.0016 – 0.0028 in.)
 Limit IN 0.10 mm (0.0039 in.)
 EX 0.12 mm (0.0047 in.)

— Note —

Measure at several places and use the maximum wear for calculation.

Fig. 3-18

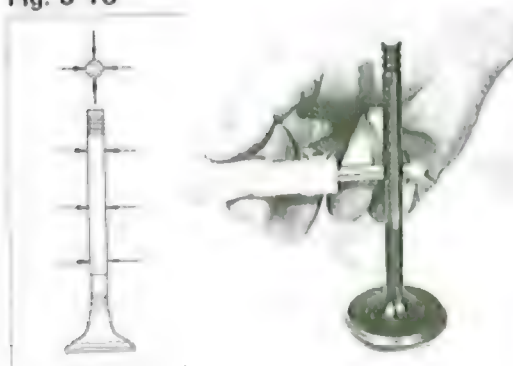
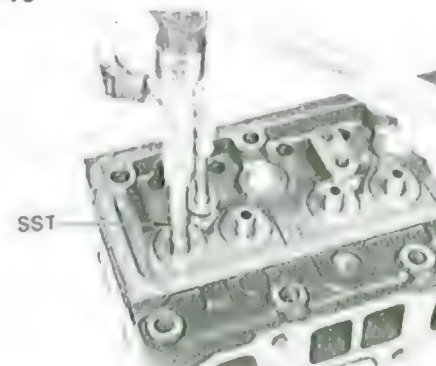
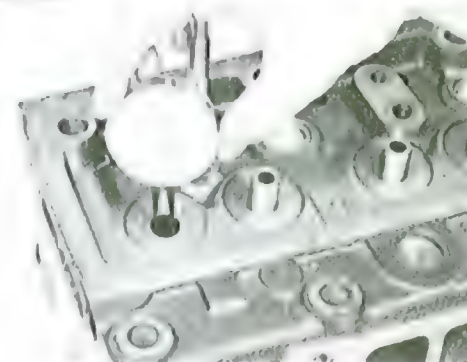


Fig. 3-19



4. If the oil clearance exceeds the limit, replace both the valve and guide.
 - (1) Using SST, drive out the valve guide from the top end toward the combustion chamber.
 SST [09201-60011]

Fig. 3-20



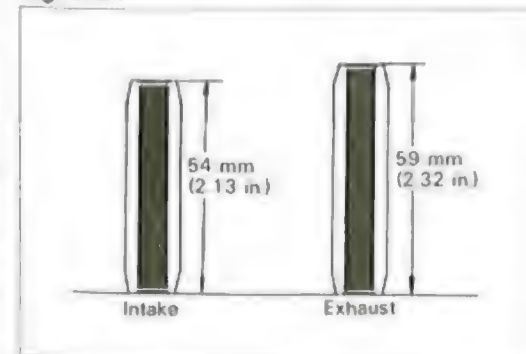
- (2) Measure the cylinder head bore for the valve guide bushing.

Both intake and exhaust

Cylinder head bore	Guide bushing
14.000 – 14.018 mm (0.5512 – 0.5519 in.)	Use STD
Over 14.018 mm (0.5519 in.)	Use O/S 0.05

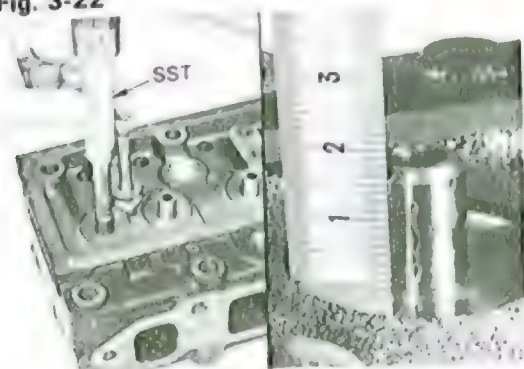
- (3) Select a bushing
- (4) If the cylinder head bore is more than 14.018 mm (0.5519 in.), machine the bore to the following dimension.
Rebored cylinder head bore dimension:
 14.050 – 14.068 mm
 (0.5531 – 0.5539 in.)

Fig. 3-21



- (5) Different bushings are used for the intake and exhaust

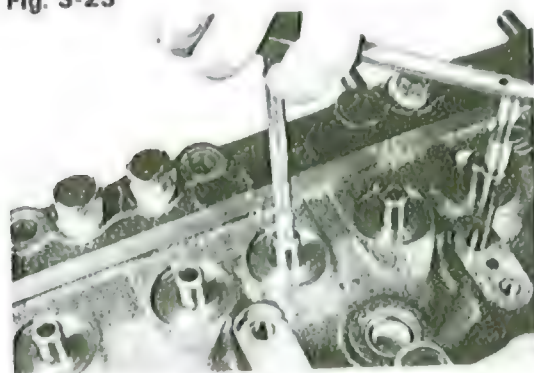
Fig. 3-22



- (6) Drive in a new valve guide until its tip projects from the top of the cylinder head by the specified length.

Protrusion from cylinder head:
 head: 17.5 mm
 (0.689 in.)

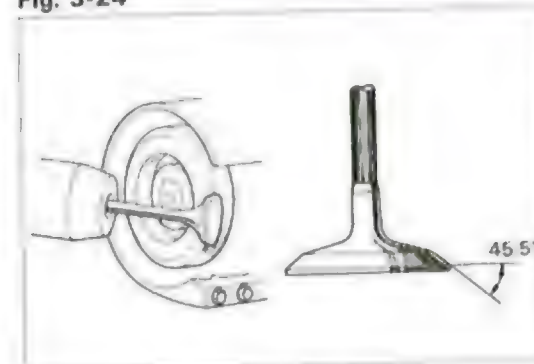
Fig. 3-23



- (7) Using a reamer, ream the valve guide to obtain the specified clearance.

Oil clearance:
STD
 IN 0.03 – 0.06 mm
 (0.0012 – 0.0024 in.)
 EX 0.04 – 0.07 mm
 (0.0016 – 0.0028 in.)

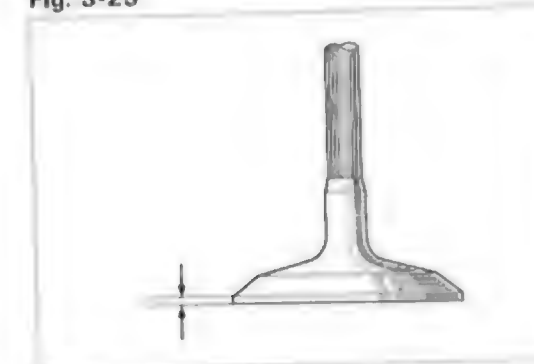
Fig. 3-24



5. Reface the valve seating face with a valve refacer.

Valve face angle: 45.5°

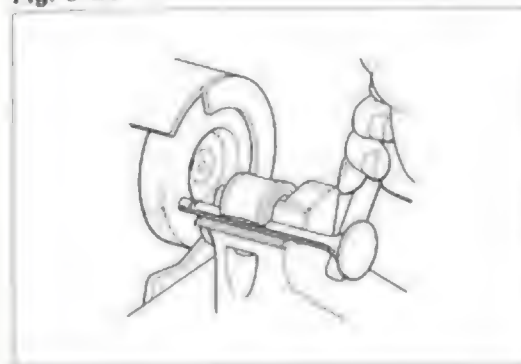
Fig. 3-25



6. Check the valve head margin thickness.

Margin thickness:
Limit IN 0.8 mm
 (0.031 in.)
 EX 1.0 mm
 (0.039 in.)

Fig. 3-26



7. Check the valve stem tip. Resurface the valve stem tip with a valve grinder if necessary.

Stem tip resurfacing:

Limit 0.5 mm
 (0.020 in.)

Overall length:

Limit IN 124.3 mm
 (4.894 in.)

EX 124.5 mm
 (4.902 in.)

Fig. 3-27



Valve Seat

1. Check the position of the valve contact with the seat. Coat the valve face with prussian blue or red lead. Locate the contact point on the valve by rotating the valve against the seat.

Contact width:

IN 1.4 mm
 (0.055 in.)

EX 1.7 mm
 (0.067 in.)

Contact position:

Middle of valve face

2. Resurface the valve seat with a 45° cutter.

Fig. 3-28

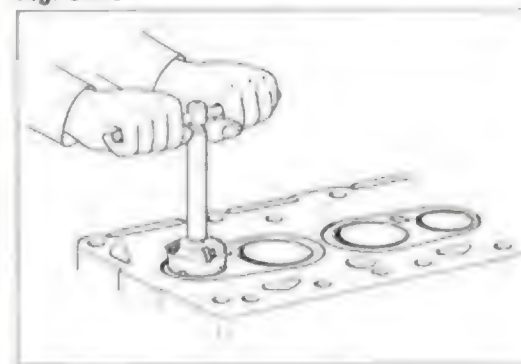
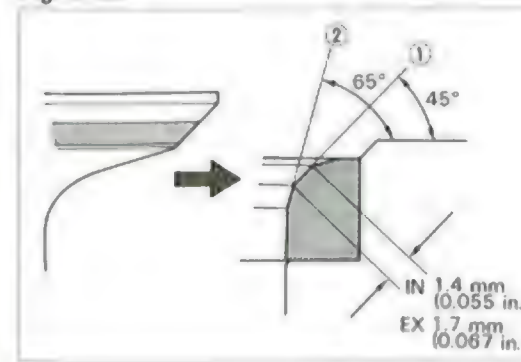
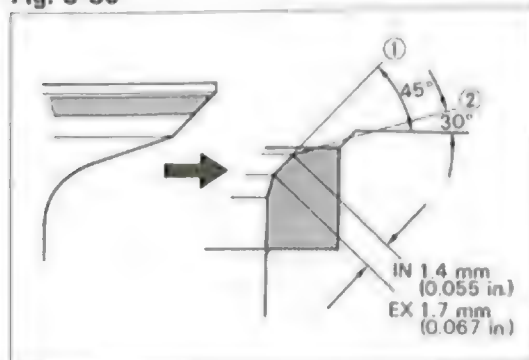


Fig. 3-29



3. Correct the seat position.
 (1) If the seat position is too high, use a 45° and 65° cutters in the order indicated.

Fig. 3-30



- (2) If the seat position is too low, use a 45° and 30° cutters in the order indicated.

Fig. 3-31



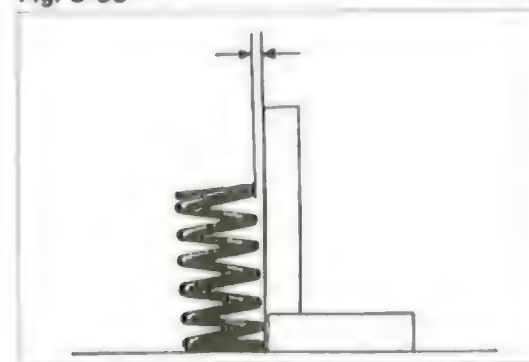
- (3) Check the valve concentricity. Lightly coat the seat with prussian blue. Install the valve and rotate. If blue appears 360° around the face, the valve stem and face are concentric. If not, replace the valve.

Fig. 3-32



4. After correction, the valve and valve seat should be lapped lightly with a lapping compound.

Fig. 3-33



Valve Spring

1. Check the squareness of the valve spring with a square.

Squareness:

Limit 1.8 mm
(0.071 in.)

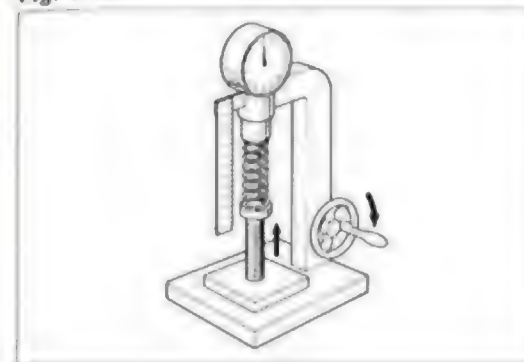
Fig. 3-34



2. Measure the spring free length. Replace any spring that does not meet specification.

Free length: 51.5 mm
(2.028 in.)

Fig. 3-35



3. Using a spring tester, measure the tension of each spring at the specified installed length. Replace any spring that does not meet specification.

Installed length: 43.0 mm
(1.693 in.)

Installed load:

STD 32.5 kg
(71.6 lb)

Limit 27 kg
(59.5 lb)

Fig. 3-36



Rocker Arm & Shaft

1. Check the rocker arm to shaft clearance. If worn excessively, disassemble and check.

Fig. 3-37



2. Arrange the rocker shaft and rocker support.

Fig. 3-38



3. Measure the clearance with a dial indicator and outside micrometer. If the clearance exceeds the limit, replace the rocker arm and/or shaft.

Oil clearance:

STD	0.018 – 0.043 mm (0.0007 – 0.0017 in.)
Limit	0.08 mm (0.0031 in.)



4. Check the contact surface.

Fig. 3-39

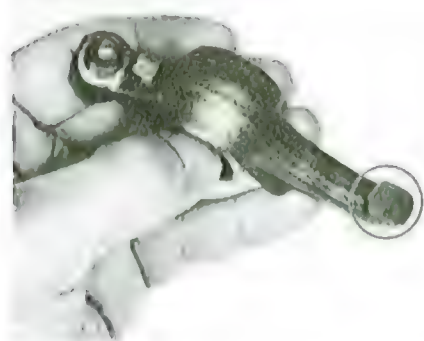


Fig. 3-40



5. If only a light ridged wear, correct the valve contacting surface of the rocker arm with a valve refacer and oil stone.



6. Assemble the rocker arms, supports and shaft aligning the oil hole of the shaft with that of No.4 support.

— Note —

There are two types of rocker arms.



Fig. 3-42



Manifold

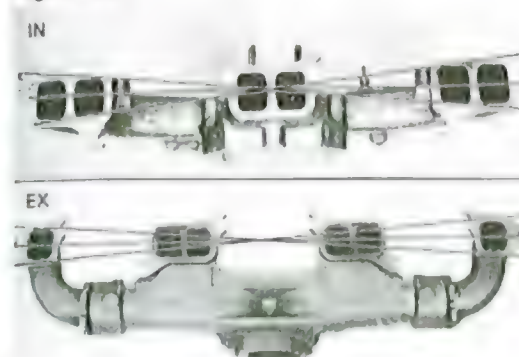
Using a straight edge and thickness gauge, check the cylinder head contacting surfaces for warpage.

Replace the manifold if it exceeds the limit

Installing surface warpage:

Limit	IN & EX	0.5 mm (0.020 in.)
-------	---------	-----------------------

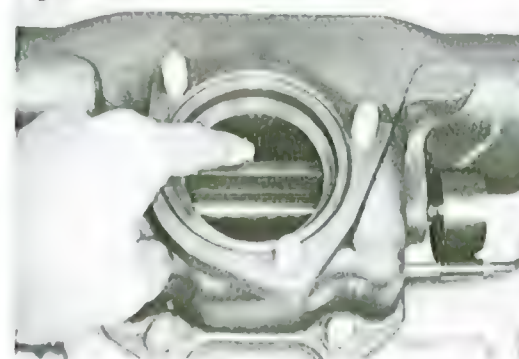
Fig. 3-43



— Note —

Measure at three places as shown in the figure.

Fig. 3-44



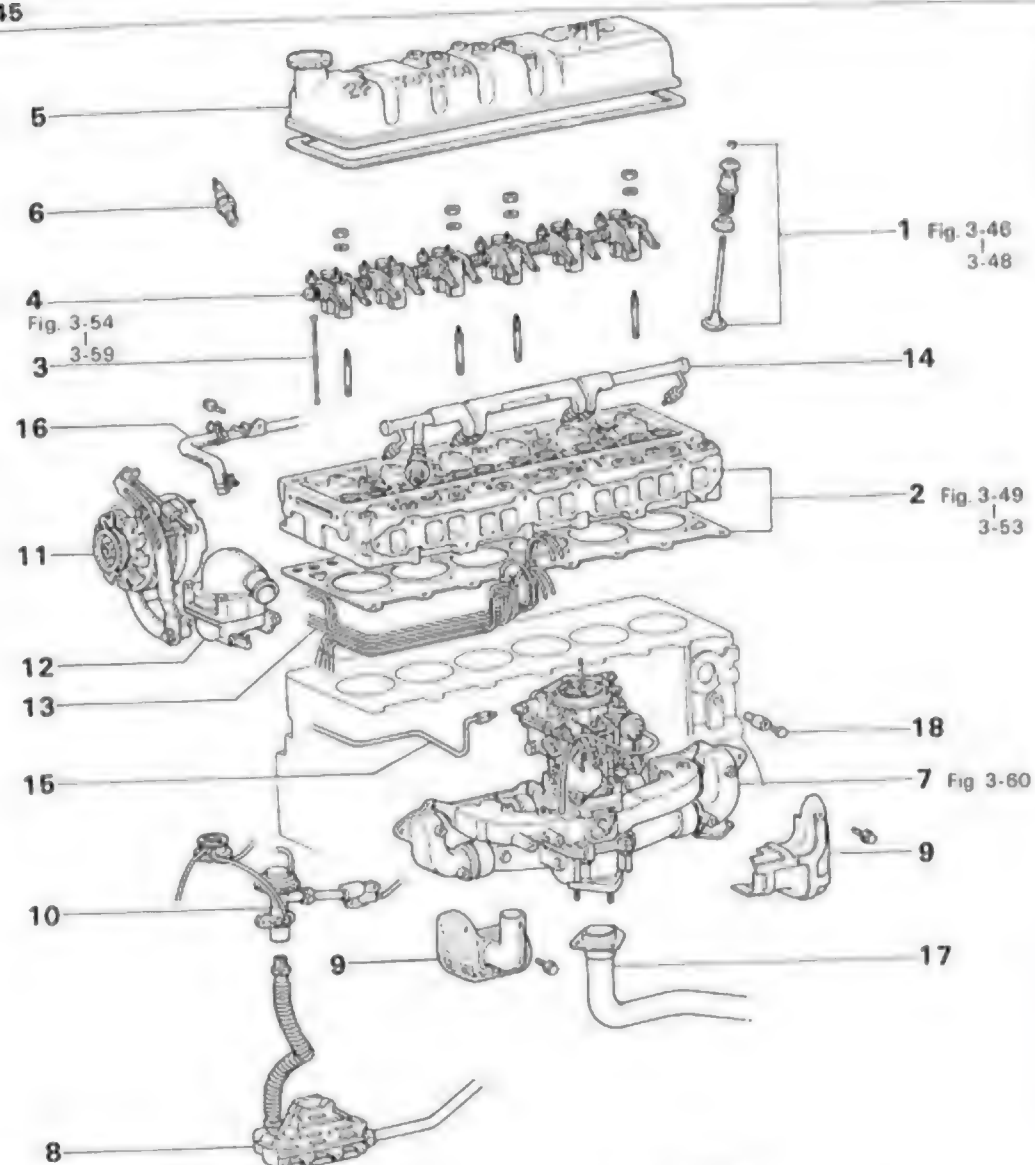
Heat Control Valve

1. Check the bi-metal coil for cracks or damage.
2. Check the control valve for deformation.
3. Make sure that the control shaft rotates smoothly.

ASSEMBLY

Assemble the parts in the numerical order shown in the figure.

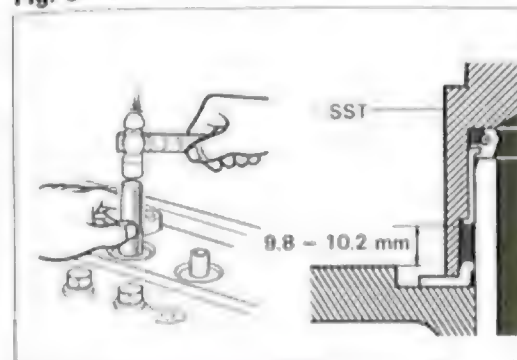
Fig. 3-45



- | | |
|---------------------------|----------------------------|
| 1. Valve & Spring | 10. EGR Valve |
| 2. Cylinder Head & Gasket | 11. Alternator |
| 3. Push Rod | 12. Water Outlet Housing |
| 4. Rocker Arm Assembly | 13. Vacuum Pipe |
| 5. Cylinder Head Cover | 14. Air Injection Manifold |
| 6. Spark Plug | 15. Fuel Pipe |
| 7. Manifold | 16. Oil Cooler Hose |
| 8. EGR Cooler | 17. Exhaust Pipe |
| 9. Insulator | 18. Water Drain Plug |

(8, 10, 11, 13, 14 USA, N.S.W. & Victoria states FJ series)

Fig. 3-46



Coat the valve stems with engine oil.
Install the spring seat and oil seal with SST [09201-31010]

Drive in distance:

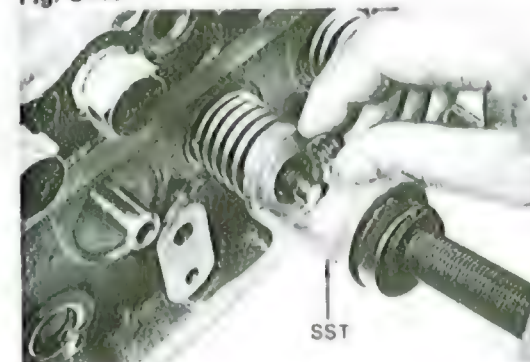
9.8 - 10.2 mm

(0.386 - 0.402 in.)

— Note —

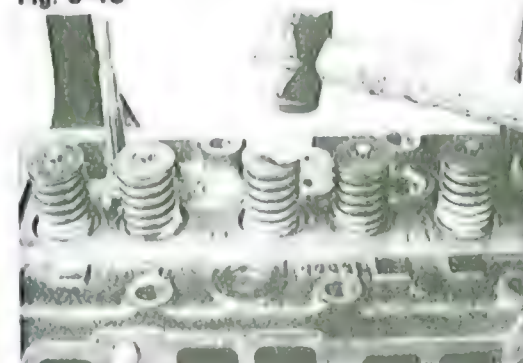
1. A new oil seal should be used whenever the valve is disassembled.
2. Coat the oil seal lip with engine oil.

Fig. 3-47



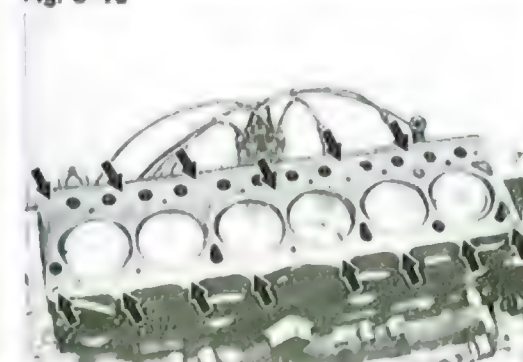
Compress the valve spring with SST and insert the spring retainer locks.
SST [09202-43012]

Fig. 3-48



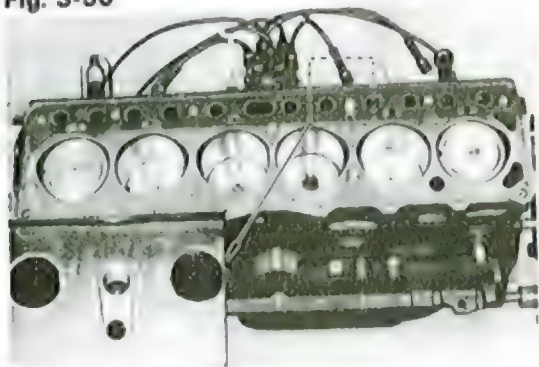
After installing the springs, lightly tap the stem ends and allow the springs to settle down snugly.

Fig. 3-49



Clean out the bolt holes with compressed air

Fig. 3-50



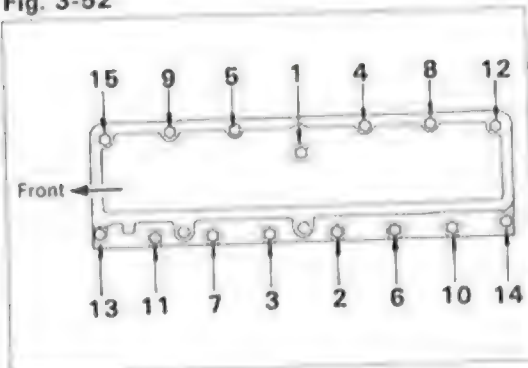
Install a new gasket as shown in the figure

Fig. 3-51



Apply a light coat of engine oil on the bolt threads and under the bolt head before installing the bolts.

Fig. 3-52



Tighten each cylinder head bolt a little at a time in the sequence shown in the figure.

Fig. 3-53



Tighten the cylinder head bolts to specified torque

Tightening torque:
11.5 – 13.5 kg-m
(84 – 97 ft-lb)

Fig. 3-54



Tighten each rocker support bolt a little at a time in the sequence shown in the figure

— Note —

Do not keep the valve push rods apart from the adjusting screws while tightening the bolts.

Fig. 3-55

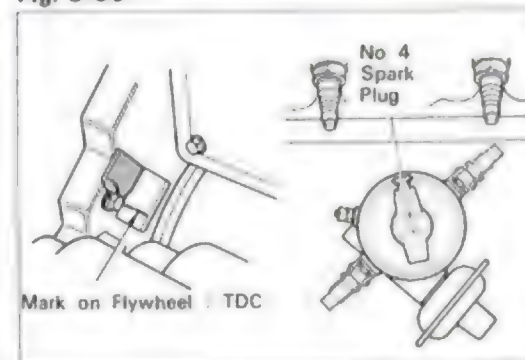


Tighten the valve rocker support bolts to specified torque

Tightening torque:

10 mm bolt	3.0 – 4.5 kg-m (22 – 32 ft-lb)
8 mm bolt	2.0 – 3.0 kg-m (15 – 21 ft-lb)

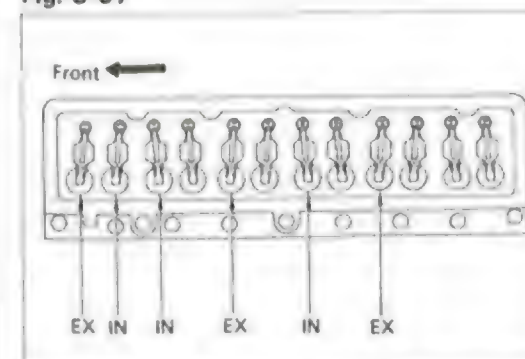
Fig. 3-56



Temporarily adjust the valve clearance

1. Set No 1 cylinder to TDC/compression. Align the mark (groove) with the pointer. The distributor rotor should face as shown

Fig. 3-57

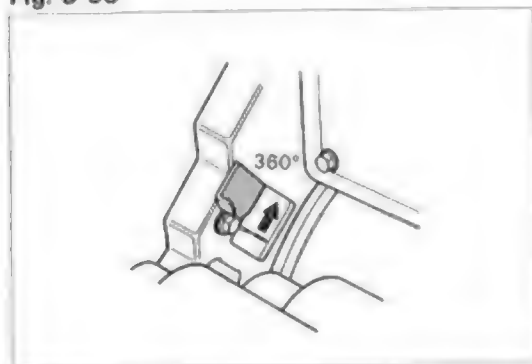


2. Adjust the valve clearance. The valve clearance is measured between the valve stem and rocker arm adjusting screw. Adjust only the valves indicated by arrows

Valve clearance (hot):

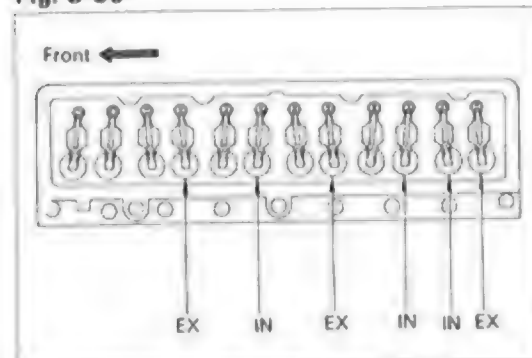
IN	0.20 mm (0.008 in.)
EX	0.35 mm (0.014 in.)

Fig. 3-58



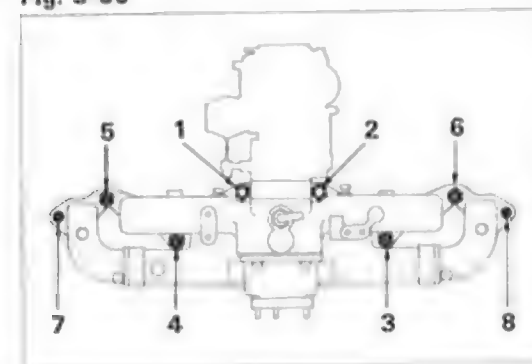
3. Rotate the crankshaft 360°.

Fig. 3-59



4. Adjust the remaining valves indicated by arrows

Fig. 3-60



Tighten each manifold bolt and nut a little at a time to the specified torque in the sequence shown in the figure.

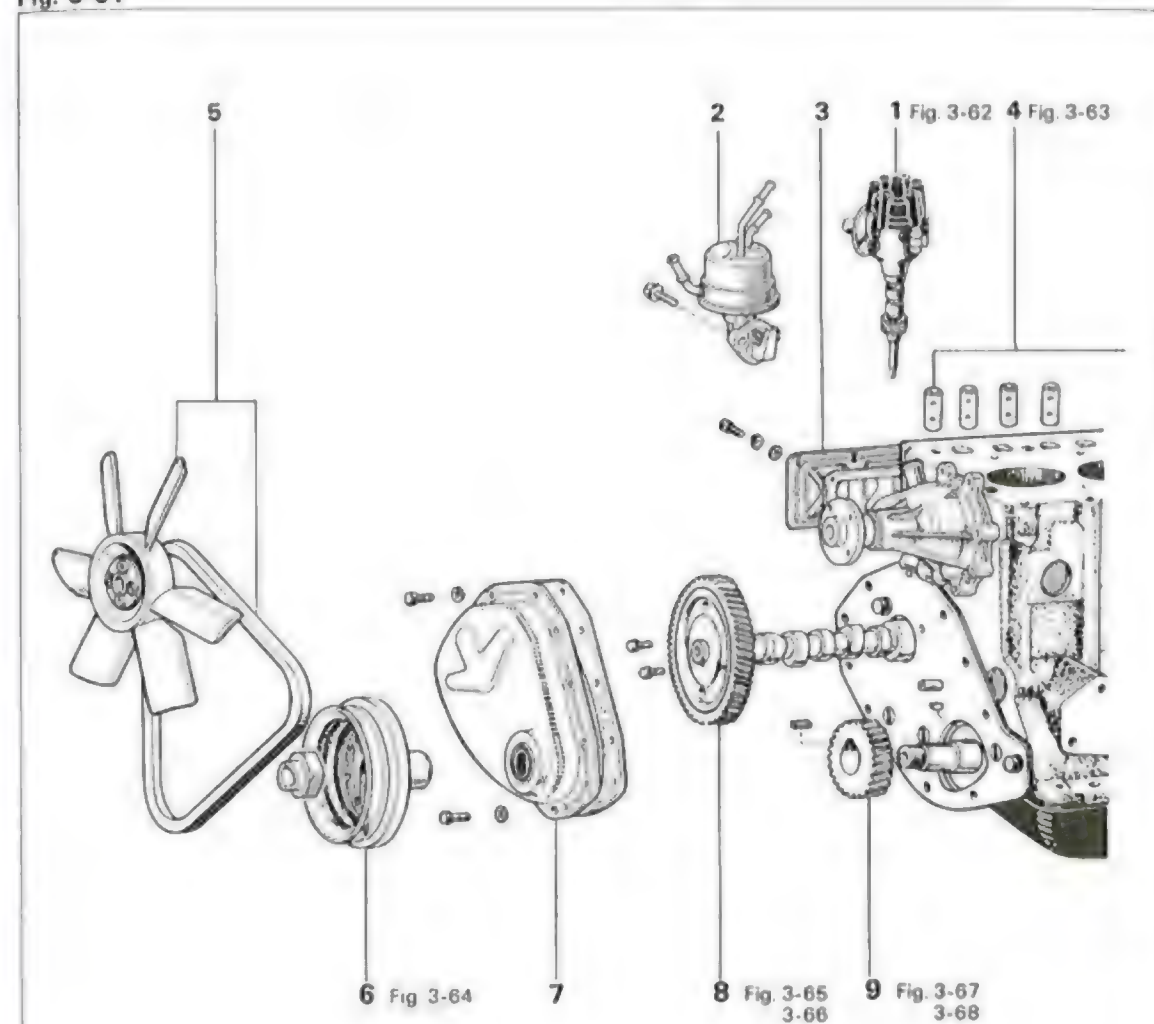
Tightening torque: 3.9 – 5.1 kg-m
(29 – 36 ft-lb)

TIMING GEAR

DISASSEMBLY

Disassemble the parts in the numerical order shown in the figure.

Fig. 3-61



1. Distributor
2. Fuel Pump
3. Valve Lifter Cover
4. Valve Lifter
5. Cooling Fan & Drive Belt

6. Crankshaft Pulley
7. Timing Gear Cover
8. Camshaft & Timing Gear
9. Crankshaft Timing Gear

Fig. 3-62



Before starting work, set No.1 cylinder piston to TDC/compression

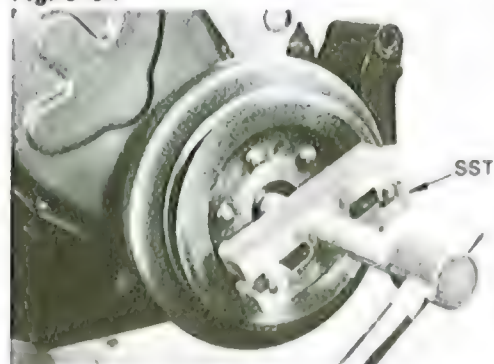
Fig. 3-63



Keep the valve lifters in correct order

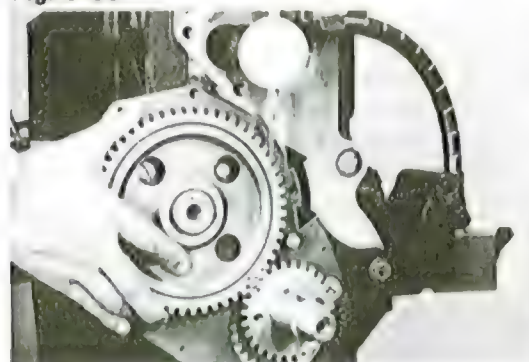


Fig. 3-64



Pull out the crankshaft pulley with SST.
SST [09213-60016]

Fig. 3-65

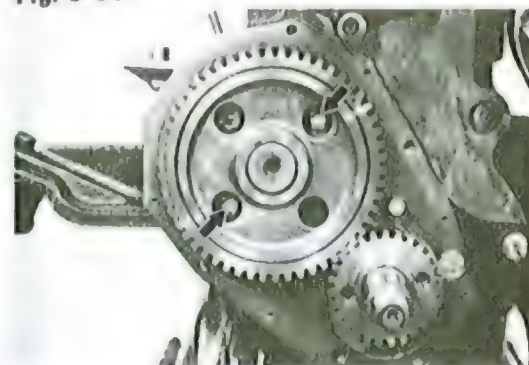


Check the timing gear backlash in several places

Backlash:

STD	0.05 – 0.12 mm (0.0020 – 0.0047 in.)
Limit	0.2 mm (0.008 in.)

Fig. 3-66

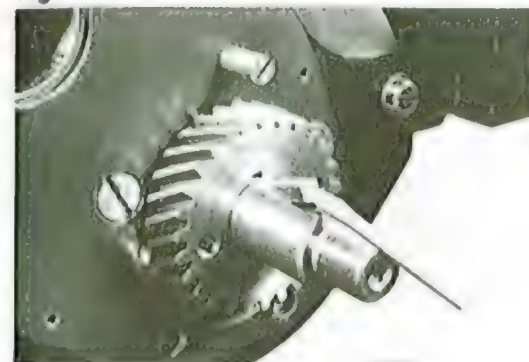


Align the matchmarks, remove the two retaining bolts of the camshaft thrust plate, and pull out the camshaft

– Note –

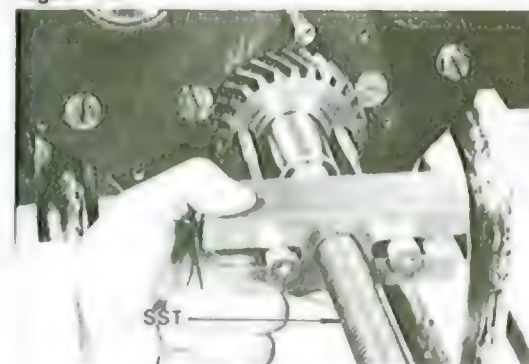
When removing the camshaft, take care not to damage the camshaft bearing.

Fig. 3-67



Remove the pulley key from the crankshaft before removing the crankshaft timing gear.

Fig. 3-68



Pull out the crankshaft timing gear with SST
SST [09213-60016]

Fig. 3-69



Fig. 3-70



Fig. 3-71

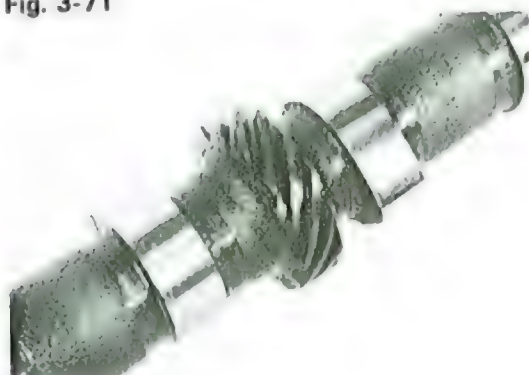
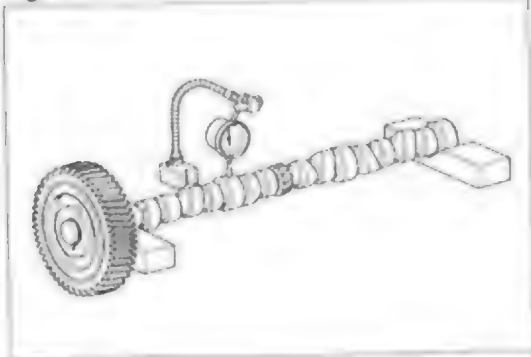


Fig. 3-72



INSPECTION & REPAIR

Valve Lifter

Check the lifters and lifter bores for wear or damage.

Measure the oil clearance.

Oil clearance:

STD 0.019 – 0.075 mm
(0.0007 – 0.0030 in.)

Limit 0.1 mm
(0.004 in.)

— Note —

If the oil clearance exceeds the limit, it should be replaced with a lifter of O/S 0.05 to obtain proper clearance.

Timing Gears

Check for cracks, wear and chipped teeth. If damaged, replace the camshaft timing gear.

Camshaft

1. Check the cam and journal for cracks or wear. If damaged, replace the camshaft.

2. Check the camshaft for runout. Replace the camshaft if it exceeds the limit.

Circle runout:

Limit 0.15 mm
(0.0059 in.)

Fig. 3-73

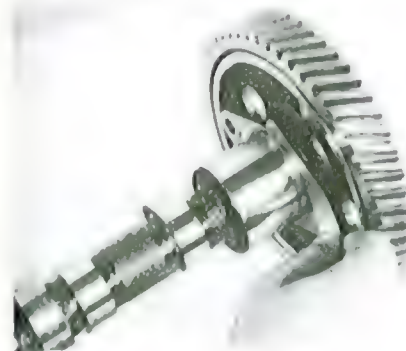


Fig. 3-74

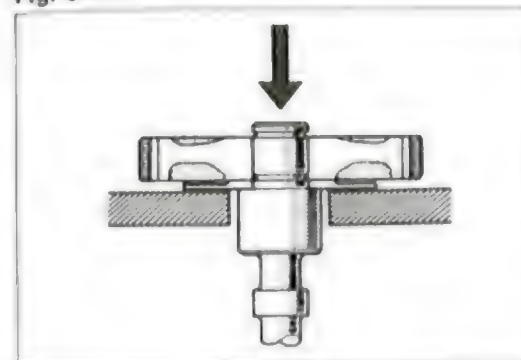


Fig. 3-75

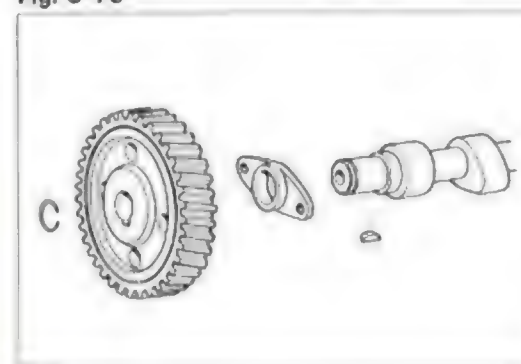
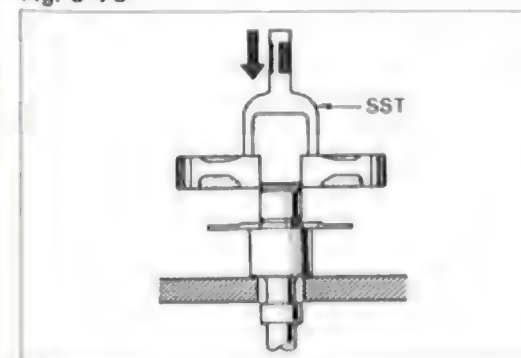


Fig. 3-76



3. Measure the camshaft thrust clearance. If it exceeds the limit, replace the thrust plate.

Thrust clearance:

STD 0.200 – 0.262 mm
(0.0079 – 0.0103 in.)

Limit 0.3 mm
(0.012 in.)



4. Replace the thrust plate.
 - (1) Take out snap ring.
 - (2) Using a press and a 23 mm socket wrench, press out the timing gear from the camshaft.

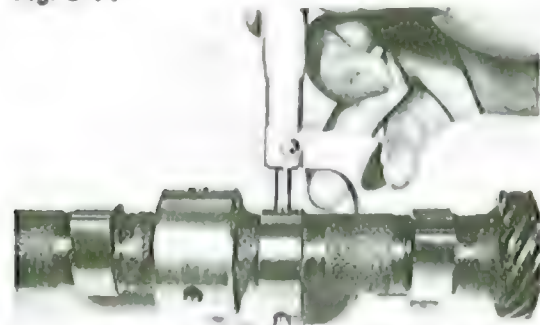


- (3) Assemble the thrust plate and gear in the manner shown.



- (4) Using a press and SST, press in the timing gear and lock it with a new snap ring. SST [09214-60010]

Fig. 3-77

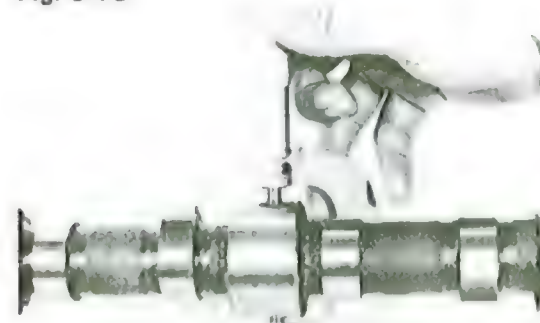


5. Measure the cam lobe height

Cam height:

Limit	IN	38.0 mm (1.496 in.)
	EX	37.9 mm (1.492 in.)

Fig. 3-78



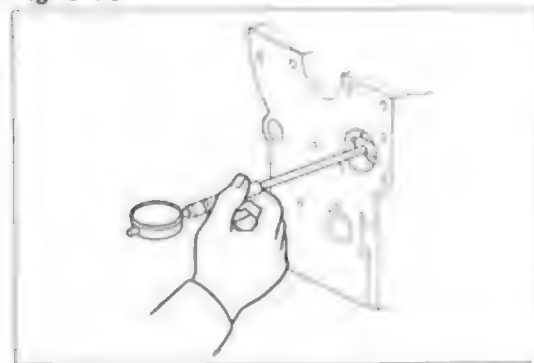
6. Measure the journal oil clearance.

- (1) Measure the camshaft journal diameter

Journal diameter:

No.1	47.955 – 47.975 mm (1.8880 – 1.8888 in.)
No.2	46.455 – 46.475 mm (1.8289 – 1.8297 in.)
No.3	44.955 – 44.975 mm (1.7699 – 1.7707 in.)
No.4	43.455 – 43.475 mm (1.7108 – 1.7116 in.)

Fig. 3-79

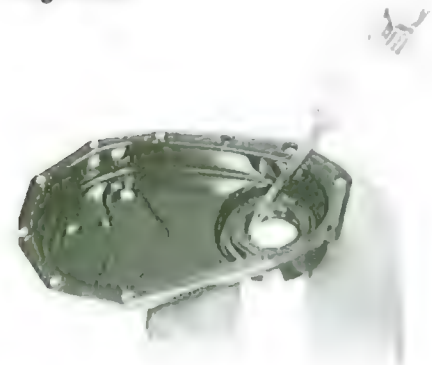


- (2) Measure the bearing inner diameter, referring to CYLINDER BLOCK section. (Refer Figs. 3-143 to 3-148.)

Oil clearance:

STD	0.025 – 0.075 mm (0.0010 – 0.0030 in.)
Limit	0.1 mm (0.004 in.)

Fig. 3-80



Crankshaft Front Oil Seal

1. Check for wear or damage
2. Replace the oil seal
 - (1) Remove the oil seal with a screwdriver

Fig. 3-81



- (2) Install a new oil seal with SST
SST [09515-35010]

— Note —

1. Drive in the oil seal until it is about even with the timing gear cover.
2. Be careful not to drive it in slant wise.

Fig. 3-82

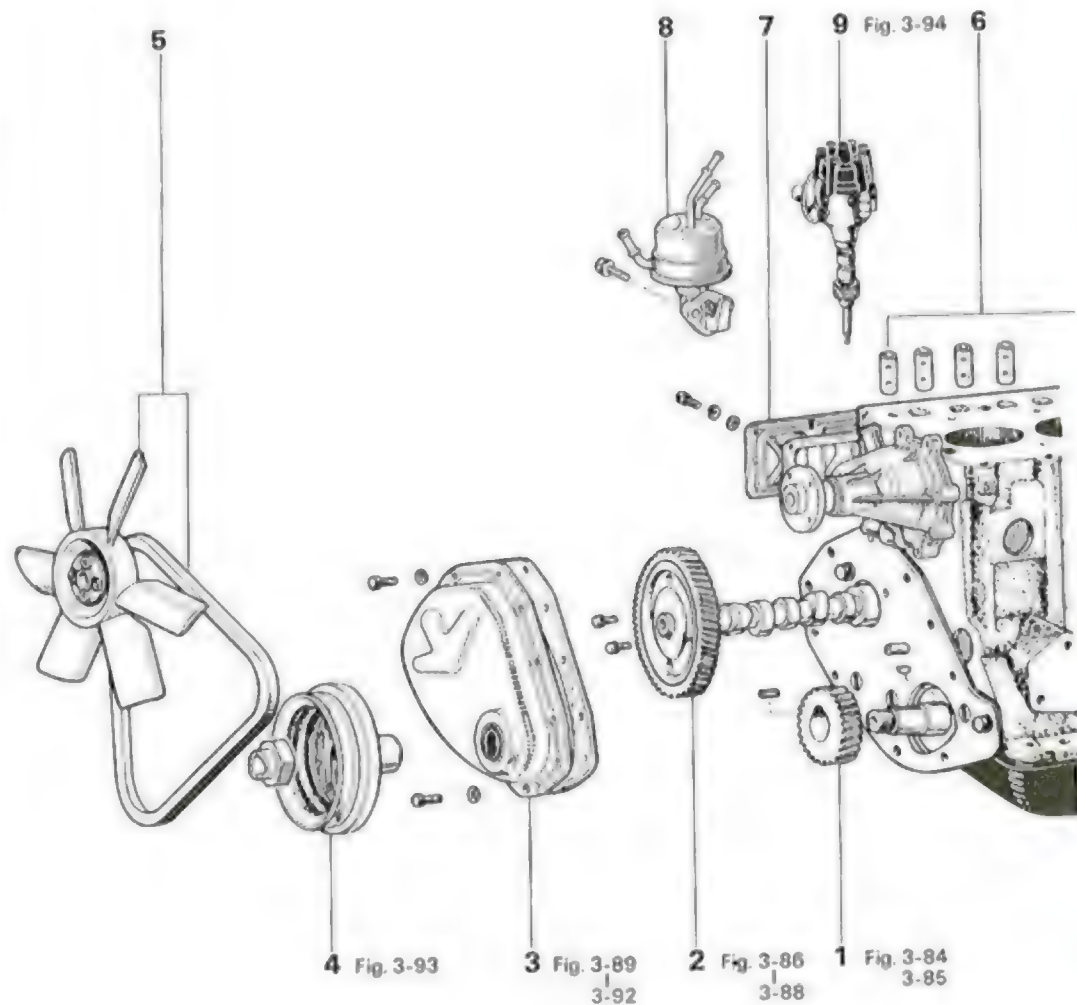


3. After driving in the seal, lightly coat the seal lip with MP grease

ASSEMBLY

Assemble the parts in the numerical order shown in the figure

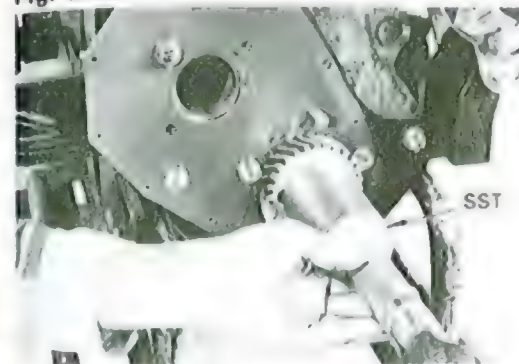
Fig. 3-83



1. Crankshaft Timing Gear
2. Camshaft & Timing Gear
3. Timing Gear Cover
4. Crankshaft Pulley
5. Cooling Fan & Drive Belt

6. Valve Lifter
7. Valve Lifter Cover
8. Fuel Pump
9. Distributor

Fig. 3-84



Drive in the crankshaft timing gear with SST
SST [09214-60010]

Fig. 3-85



Set No 6 cylinder piston to TDC/compression

Fig. 3-86



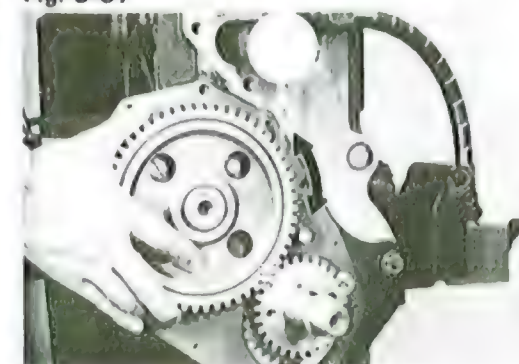
Align the matchmarks and tighten the camshaft thrust plate.

Tightening torque: 1.0 – 1.6 kg-m
(8 – 11 ft-lb)

– Note –

At this time, No. 6 cylinder should be at TDC/compression.

Fig. 3-87

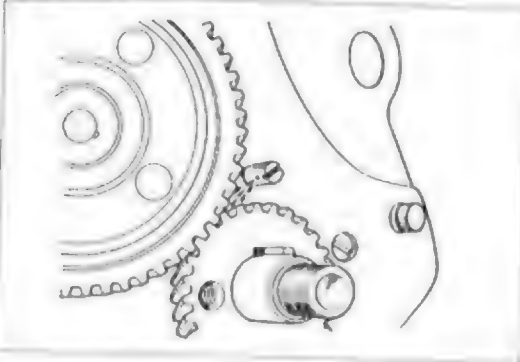


Check the timing gear backlash in several places.

Backlash:

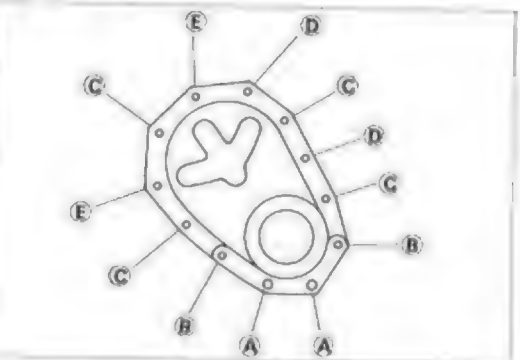
STD	0.05 – 0.12 mm (0.0020 – 0.0047 in.)
Limit	0.2 mm (0.008 in.)

Fig. 3-88



If the oil nozzle was removed, screw in and stake the plate at two places. The oil hole should be faced as shown in the figure.

Fig. 3-89



Install the timing gear cover and pulley as follows

1. Install each bolt referring to the figure and the following chart.

Location	Bolt Length mm (in.)	Location	Bolt Length mm (in.)
A	25 (0.984)	E	w/o Oil Cooler 8 (0.315)
B	12 (0.472)		w/ Oil Cooler 16 (0.630)
C	8 (0.315)		
D	16 (0.630)		

— Note —

Apply liquid sealer onto the bolt threads of A.

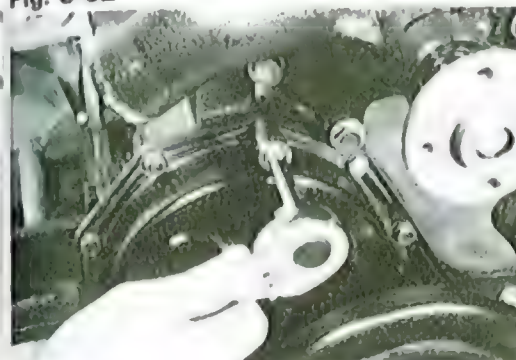


2. Finger tighten all bolts.



3. Drive in the pulley with SST to position the timing gear cover correctly. SST [09214-60010]

Fig. 3-92



4. After installing the pulley, tighten the cover bolts

Tightening torque:

6 mm bolt 0.6 – 0.8 kg-m
(53 – 69 in.-lb)

10 mm bolt 1.6 – 2.4 kg-m
(12 – 17 ft-lb)

Fig. 3-93



5. Tighten the claw nut

Tightening torque:

16.0 – 20.0 kg-m
(116 – 144 ft-lb)

— Note —

Apply a light coat of engine oil on the nut before installing.

Fig. 3-90



Fig. 3-91



Fig. 3-94

SEE
IGNITION SYSTEM DISTRIBUTOR
INSTALLATION SECTION

Figs. 8-79 to 8-86

OR

Figs. 8-87 to 8-93

Install the distributor

CYLINDER BLOCK

DISASSEMBLY

Disassemble the parts in the numerical order shown in the figure

Fig. 3-95

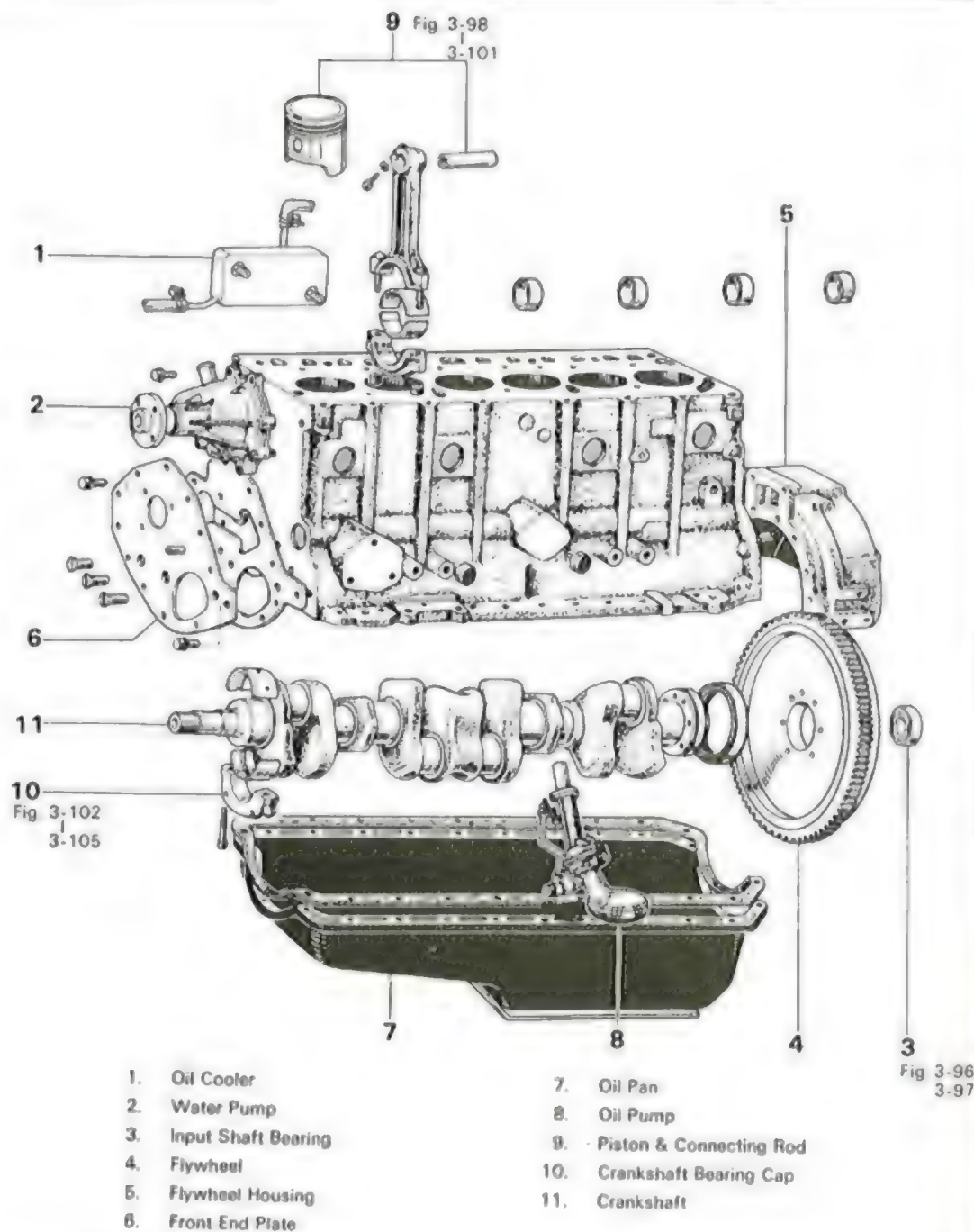
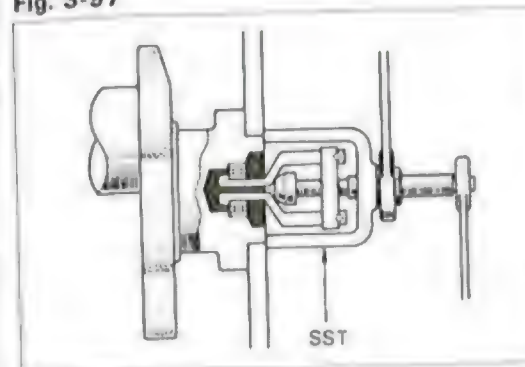


Fig. 3-96



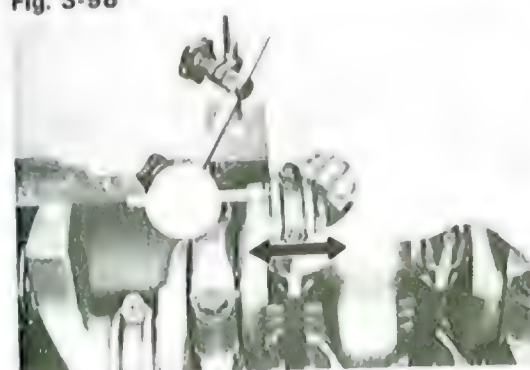
Check the input shaft bearing for wear or damage.
Check to see that there is no drag on the bearing when it is turned

Fig. 3-97



If necessary, remove the input shaft bearing with SST
SST [09303-55010]

Fig. 3-98



Measure the connecting rod thrust clearance.
If it exceeds the limit, replace the connecting rod

Thrust clearance:

STD	0.08 – 0.24 mm (0.0031 – 0.0094 in.)
Limit	0.3 mm (0.012 in.)

Fig. 3-99



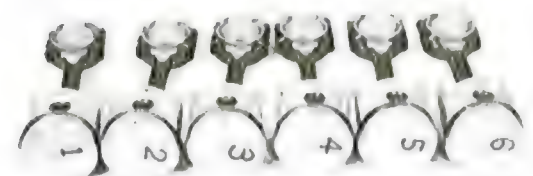
Place matchmarks on the cap and connecting rod

Fig. 3-100



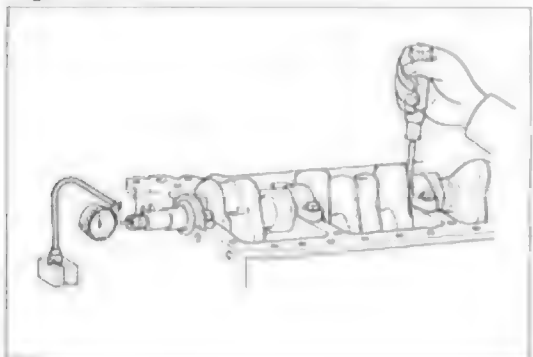
Cover the rod bolts with short pieces of hose to protect the crankshaft from damage.

Fig. 3-101



Keep the pistons and connecting rod caps in correct order.

Fig. 3-102



Measure the crankshaft thrust clearance. If it exceeds the limit, replace the No.3 bearing as a set.

Thrust clearance:

STD 0.06 – 0.16 mm
(0.0024 – 0.0063 in.)

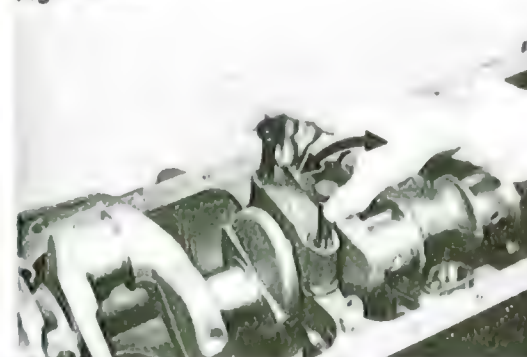
Limit 0.3 mm
(0.012 in.)

Fig. 3-103



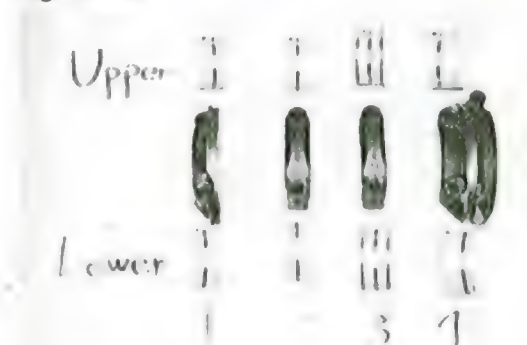
Loosen each crankshaft bearing bolt a little at a time in the sequence shown in the figure.

Fig. 3-104



If the crankshaft bearing cap will not come off, remove it by raising the bolts and prying fore and aft.

Fig. 3-105



Keep the crankshaft bearings and caps in correct order.

Fig. 3-106



Fig. 3-107

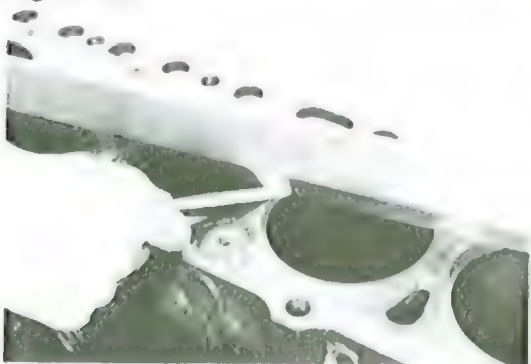


Fig. 3-108

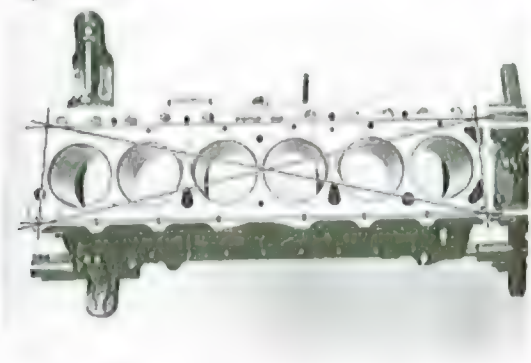
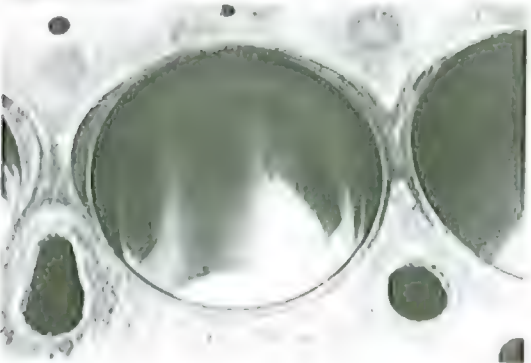


Fig. 3-109



INSPECTION & REPAIR

Cylinder Block

1. Clean the cylinder block and check for cracks or scores

2. Using a precision straight edge and thickness gauge, check the cylinder block top-side surface for warpage

Topside surface warpage:

Limit

0.15 mm
(0.0059 in.)

3. Check for warpage along the indicated lines

4. Visually check the cylinder for vertical scratches. If deep scratches are present, the cylinder must be rebored.

Fig. 3-110

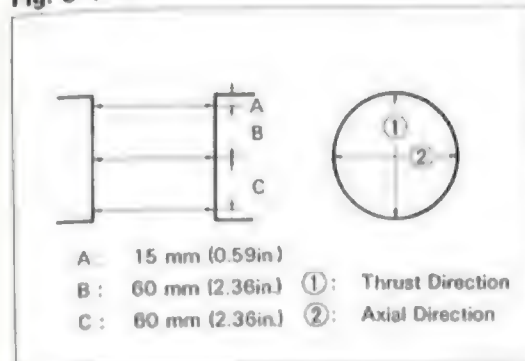


Fig. 3-111

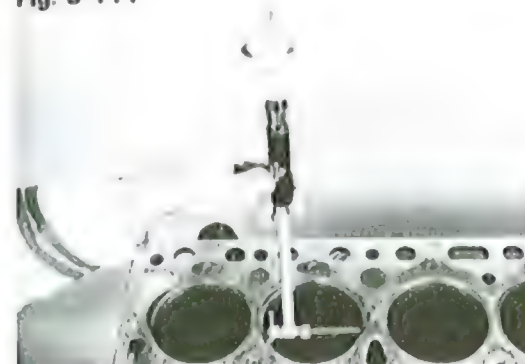


Fig. 3-112

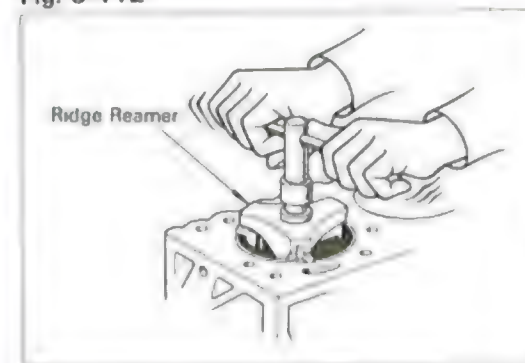




Fig. 3-113



-  5. Measure the cylinder bore at the position shown in the figure.

-  6 If the bore exceeds specification, it must be rebored.

Cylinder bore:

STD 94.00 – 94.05 mm
(3.7008 – 3.7027 in.)

Wear:


Limit 0.2 mm (0.008 in.)

Taper and out-of-round:

Limit 0.02 mm (0.0008 in.)

Difference of bore limit between each cylinder:

Less than 0.05 mm
(0.0020 in.)

-  7 If the wear is less than 0.2 mm (0.008 in.), use a ridge reamer to machine the piston ring ridge at the top of the cylinder.

Piston Pin & Connecting Rod

1. Try to move the piston back and forth on the piston pin.
If any movement is felt, replace the piston and pin.

Fig. 3-114



2. Remove the piston ring with a piston ring expander.

Fig. 3-115



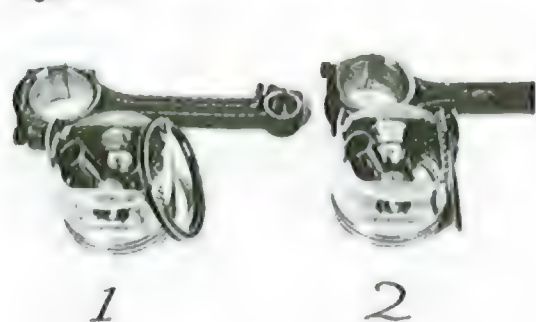
3. Remove the piston pin bolt

Fig. 3-116



4. Push out the piston pin

Fig. 3-117



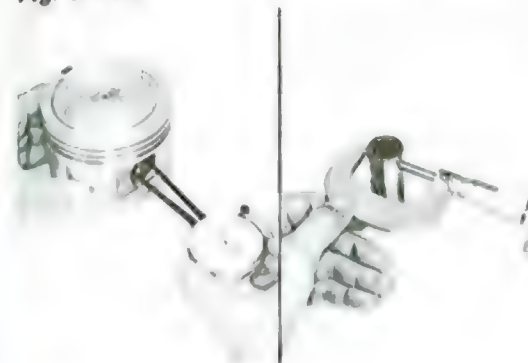
5. After disassembly, arrange the parts in correct order

Fig. 3-118



6. Check the piston pin fit. Coat the pin with engine oil. It should then be possible to push the pin into the piston hole with thumb pressure.

Fig. 3-119

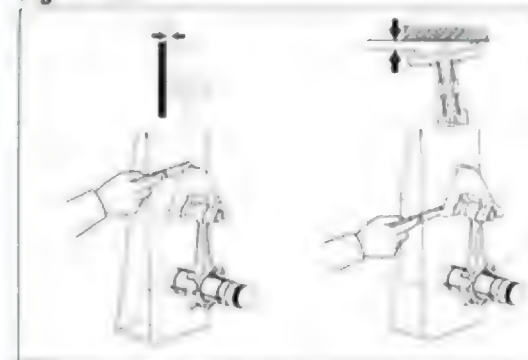


7. Measure the oil clearance between the piston and piston pin. If it exceeds the limit, replace the piston and pin as a set.

Oil clearance:

STD	0.008 – 0.012 mm (0.0003 – 0.0005 in.)
Limit	0.07 mm (0.0028 in.)

Fig. 3-120



8. Check the connecting rod for bending or twisting.

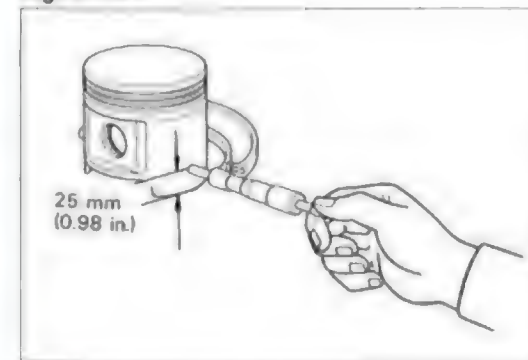
Bend per 100 mm (3.94 in.):

Limit	0.05 mm (0.0020 in.)
-------	-------------------------

Twist per 100 mm (3.94 in.):

Limit	0.15 mm (0.0059 in.)
-------	-------------------------

Fig. 3-121



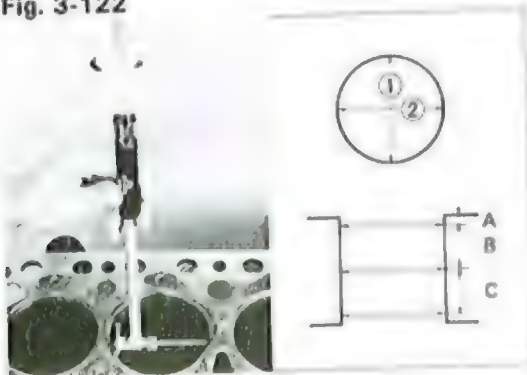
Piston Clearance

1. Measure the piston diameter at right angle to the piston pin center line. Measurement must be made at room temperature (20°C or 68°F)

Piston diameter:

STD	93.96 – 94.01 mm (3.6992 – 3.7012 in.)
-----	---

Fig. 3-122



- 2 Measure the cylinder bore and subtract the piston measurement. If clearance exceeds specification, replace the piston.

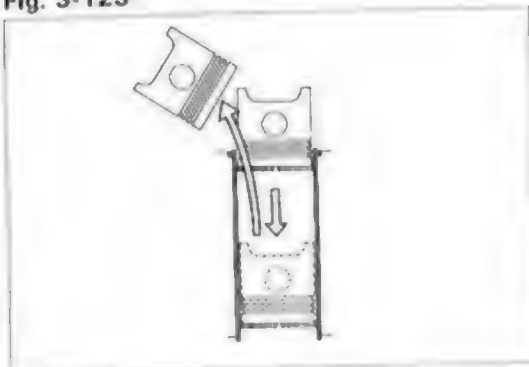
Piston oil clearance:

STD 0.03 – 0.05 mm
(0.0012 – 0.0020 in.)

– Note –

Use the measurement where the wear is at maximum.

Fig. 3-123

**Piston Ring**

1. Measure the ring end gap

(1) Using a piston, insert the ring into the cylinder. Position the ring at the lower part of the cylinder bore.

- (2) Measure the end gap. If it exceeds specification, the ring must be replaced.

End gap:

No.1 0.20 – 0.56 mm
(0.0079 – 0.0220 in.)

No.2 0.20 – 0.58 mm
(0.0079 – 0.0228 in.)

Oil

NP 0.20 – 0.88 mm
(0.0079 – 0.0346 in.)

Riken 0.20 – 0.58 mm
(0.0079 – 0.0228 in.)

2. Measure the ring groove clearance. If it exceeds specification, replace the ring and/or piston.

Ring groove clearance:

STD No.1 0.03 – 0.07 mm
(0.0012 – 0.0028 in.)

No.2 0.02 – 0.06 mm
(0.0008 – 0.0024 in.)

Oil

N.S.W 0.03 – 0.07 mm
(0.0012 – 0.0028 in.)

Others 0.04 – 0.19 mm
(0.0016 – 0.0075 in.)

Fig. 3-124



Fig. 3-125

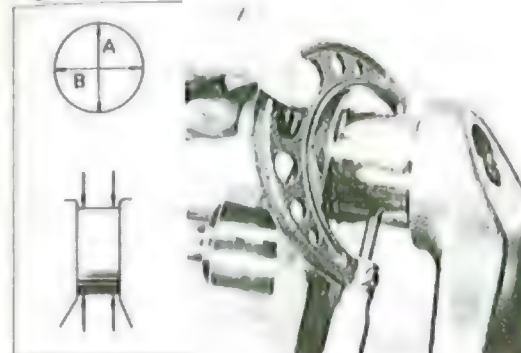


Fig. 3-126

**Crankshaft Pin & Bearing**

1. Check the bearings for flaking or scoring. If bearings are damaged, replace them.

Fig. 3-127



2. Measure the crank pin diameter.

If wear is excessive, the crankshaft must be reground or replaced.

Crank pin diameter:

STD 53.98 – 54.00 mm
(2.1252 – 2.1260 in.)

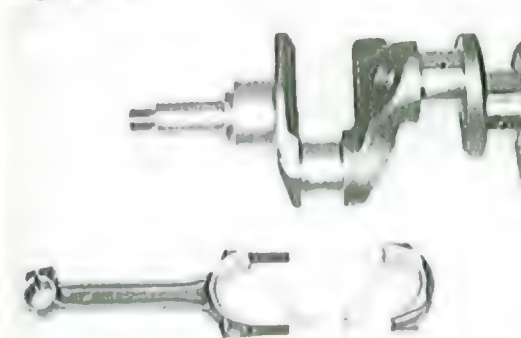
Taper and out-of-round:

Limit 0.01 mm
(0.0004 in.)

– Note –

Measure A and B diameters in two places.

Fig. 3-128

**Measure the crank pin oil clearance**

1. Clean the crankshaft pin, rod, cap and bearing.

Fig. 3-129



2. Lay a strip of plastigage across the pin.

Fig. 3-130



3. Tighten the cap nuts to specified torque.

Tightening torque:

4.8 – 7.6 kg-m

(35 – 54 ft-lb)

4. Loosen the cap nuts.

– Note –

Do not turn the connecting rod.

Fig. 3-131



5. Measure the plastigauge at its widest point.

If clearance is not within specification, replace the bearings.

Bearing oil clearance:

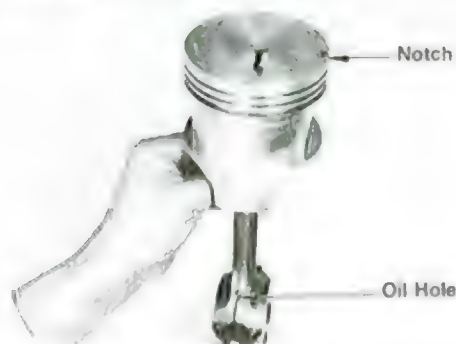
STD 0.02 – 0.06 mm
(0.0008 – 0.0024 in.)

Limit 0.1 mm
(0.004 in.)

U/S bearing size:

U/S 0.05, 0.25, 0.50

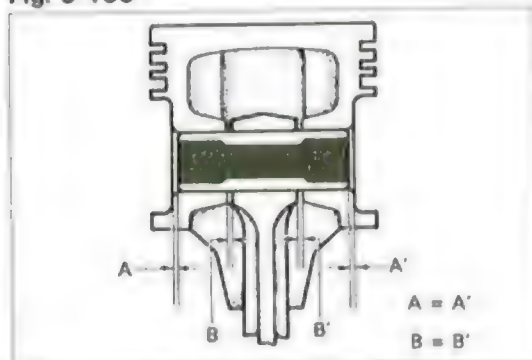
Fig. 3-132



Assemble The Piston & Connecting Rod

1. Align the notch on the piston with the oil hole of the connecting rod

Fig. 3-133



2. Center the piston pin in the piston, and position the connecting rod in the center of the two piston pin bosses. Tighten the pin bolt

Tightening torque:

5.4 – 7.0 kg-m

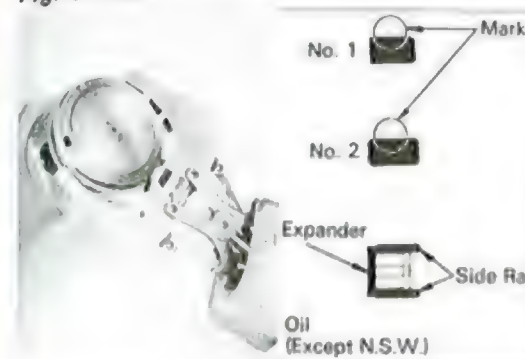
(40 – 50 ft-lb)

Fig. 3-134



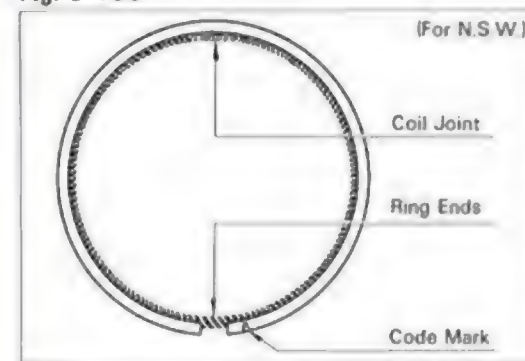
3. Rock the piston at right angle to the pin and verify that movement is smooth

Fig. 3-135



4. Install the piston rings with a piston ring expander. Install two compression rings with the code marks facing upward

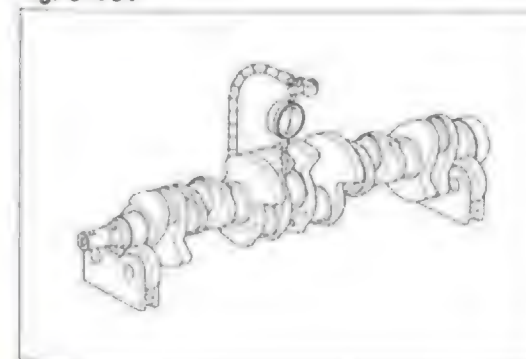
Fig. 3-136



– Note –

- For N.S.W. vehicles, make sure that the expander coil joint is at the opposite side of the oil ring ends when assembling.
- Install the oil ring with the code mark facing upward.

Fig. 3-137



Crankshaft & Bearing

1. Check the crankshaft for runout and if it exceeds the limit, replace

Circle runout:

Limit 0.1 mm
(0.004 in.)

Fig. 3-138



Fig. 3-139

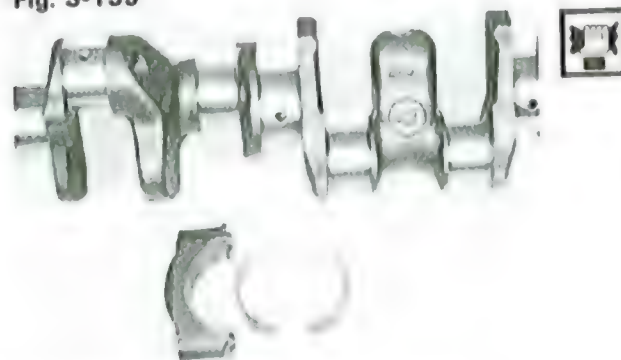


Fig. 3-140

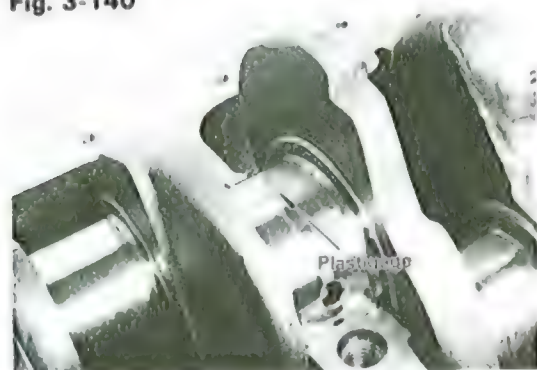
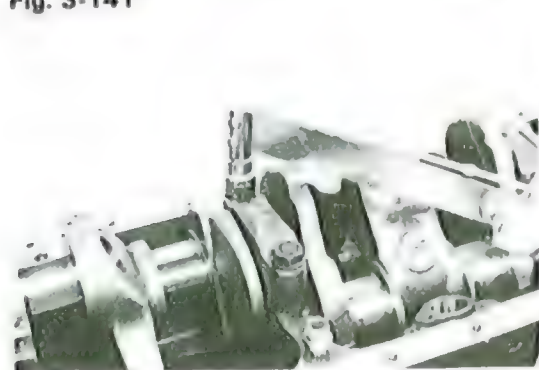


Fig. 3-141



2. Measure the crankshaft main journal. If wear is excessive, the crankshaft must be reground or replaced.

Main journal diameter:**STD**

No.1	66.972 – 66.996 mm (2.6367 – 2.6376 in.)
No.2	68.472 – 68.496 mm (2.6957 – 2.6967 in.)
No.3	69.972 – 69.996 mm (2.7548 – 2.7557 in.)
No.4	71.472 – 71.496 mm (2.8139 – 2.8148 in.)

Taper and out-of-round:

Limit 0.01 mm (0.0004 in.)

– Note –

Measure A and B diameters in two places.

3. Measure the main journal oil clearance.
(1) Clean the journal, cap and bearing.

- (2) Lay a strip of plastigage across the journal

- (3) Tighten the cap bolts to specified torque

Tightening torque:**No.1 – No.3**

12.5 – 15.0 kg-m
(91 – 108 ft-lb)

No.4 10.5 – 13.0 kg-m
(76 – 94 ft-lb)

– Note –

Do not turn the crankshaft.

Fig. 3-142



- (4) Measure the plastigage at its widest point. If clearance is not within specification, replace the bearings

Oil clearance:

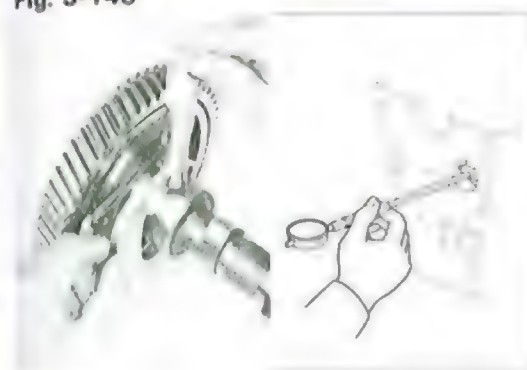
STD 0.020 – 0.044 mm
(0.0008 – 0.0017 in.)

Limit 0.10 mm
(0.0039 in.)

U/S bearing:

0.05, 0.25, 0.50

Fig. 3-143

**Camshaft Bearing**

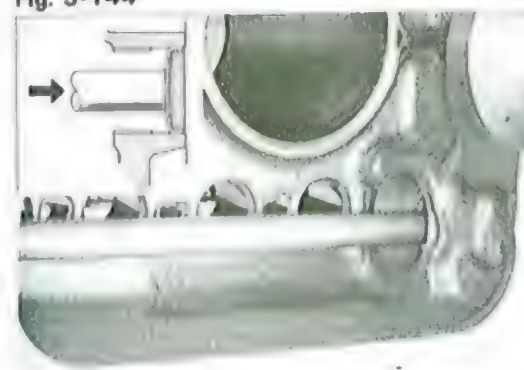
1. Check the bearing oil clearance

Oil clearance:

STD 0.025 – 0.075 mm
(0.0010 – 0.0030 in.)

Limit 0.1 mm
(0.0039 in.)

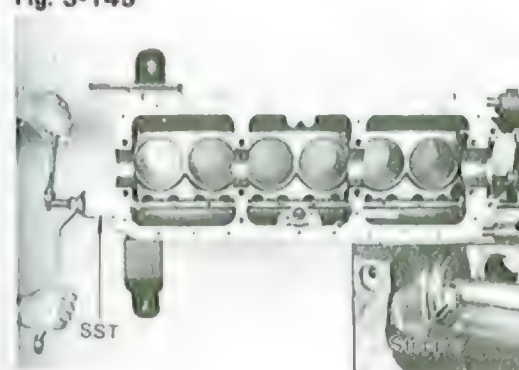
Fig. 3-144



2. Replace the camshaft bearing.

- (1) Remove the camshaft rear expansion plug.

Fig. 3-145



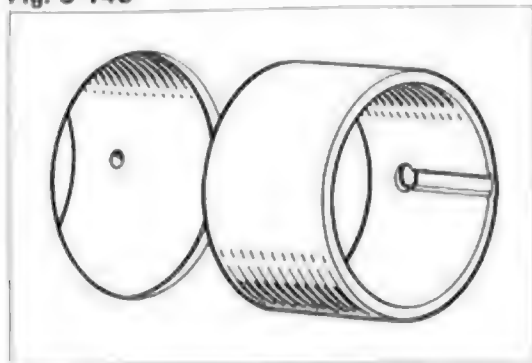
- (2) Remove the camshaft bearings with SST.

SST [09215-00010]
[09215-00100]

– Note –

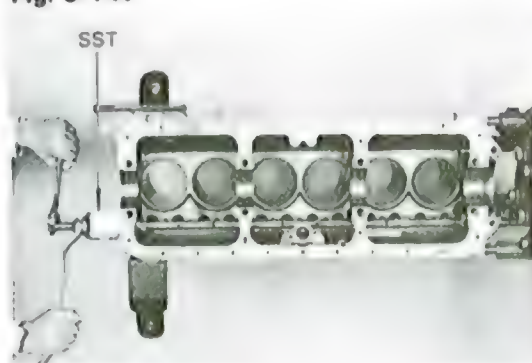
- Shorten the shaft of SST to proper length by inserting the stopper into the shaft hole as shown in the figure.
- Remove each bearing one at a time.

Fig. 3-146



- (3) When installing the bearings, align the bearing oil holes with those of the cylinder block

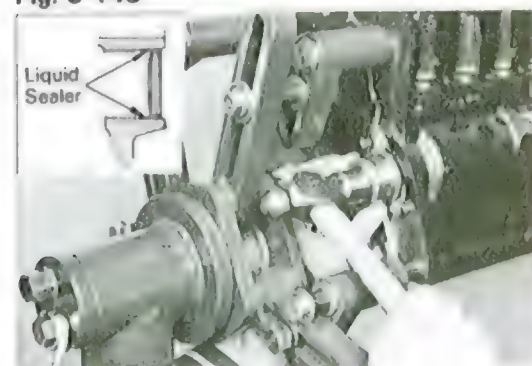
Fig. 3-147



- (4) Install new bearings with SST
SST [09215-00010]
[09215-00100]

— Note —
Install each bearing one at a time.

Fig. 3-148



- (5) Install a new expansion plug with liquid sealer

Fig. 3-149



Flywheel

1. Check the surface contacting the clutch disc.
2. Measure the runout of the surface contacting the clutch disc.

Runout:

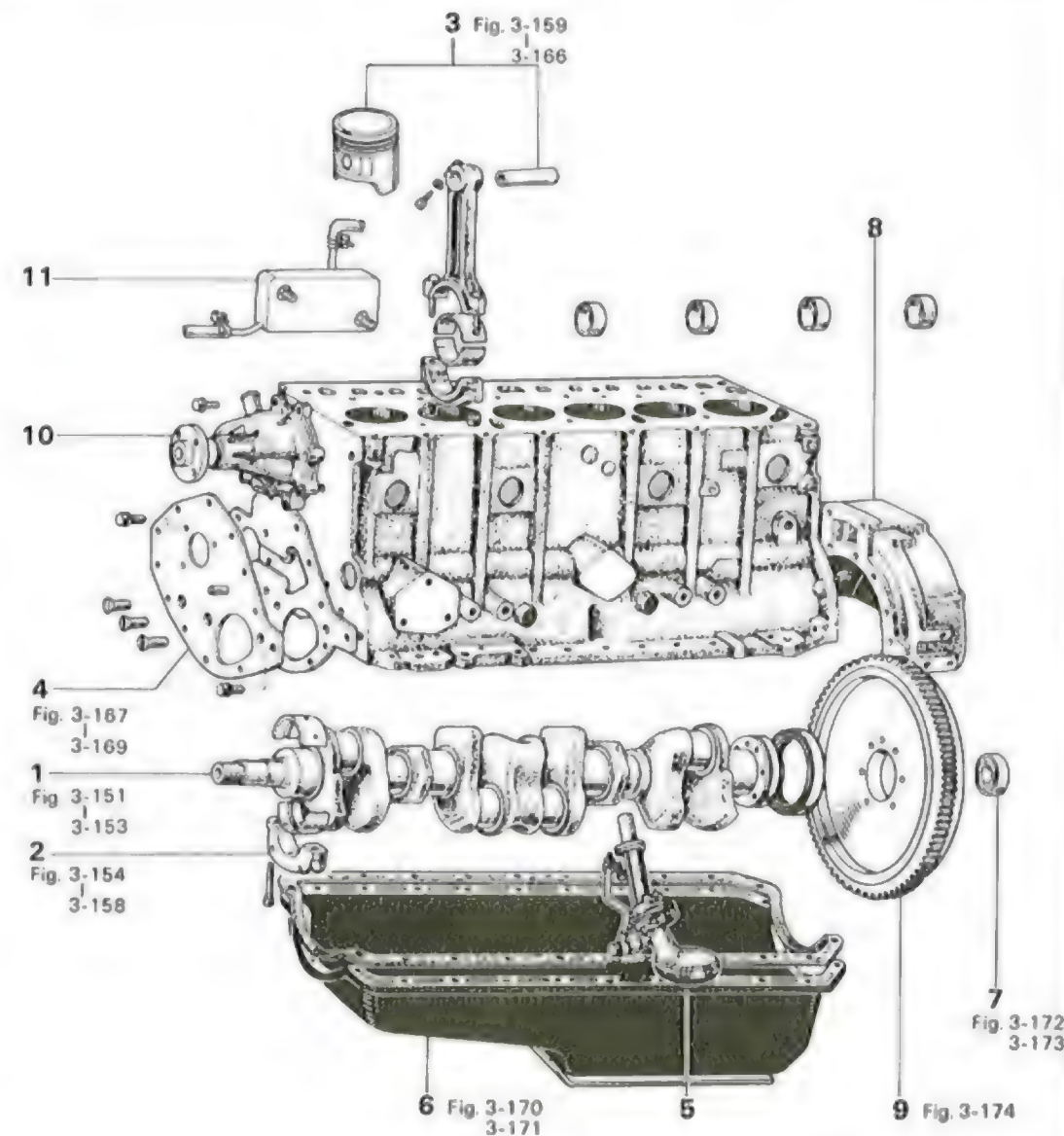
Limit 0.1 mm
(0.004 in.)

3. Check the ring gear.

ASSEMBLY

Assemble the parts in the numerical order shown in the figure.

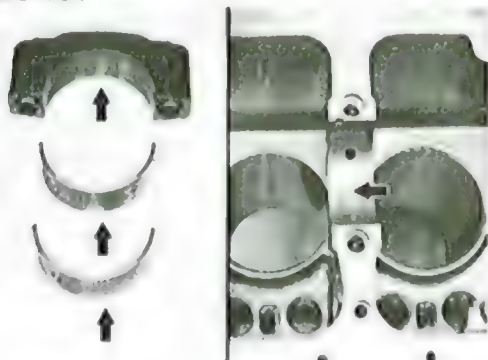
Fig. 3-150



1. Crankshaft
2. Crankshaft Bearing Cap
3. Piston & Connecting Rod
4. Front End Plate
5. Oil Pump
6. Oil Pan

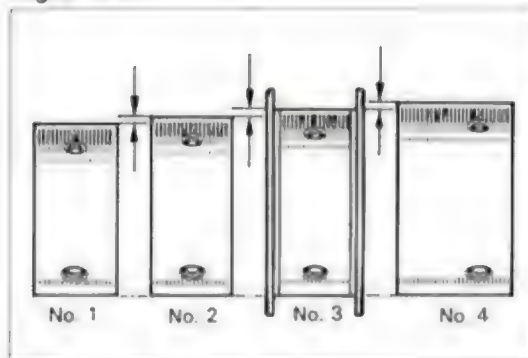
7. Input Shaft Bearing
8. Flywheel Housing
9. Flywheel
10. Water Pump
11. Oil Cooler

Fig. 3-151



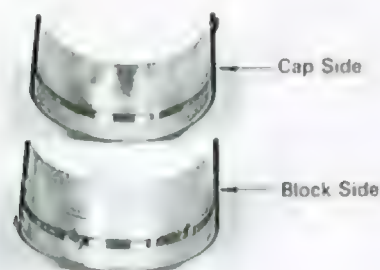
Do not allow oil to get on the back side of the bearing

Fig. 3-152



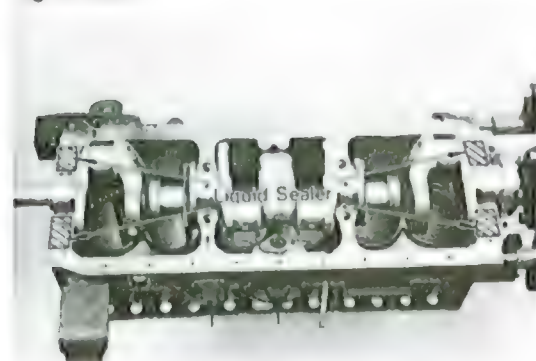
All main bearings are different. Install the bearings in the block and caps, lubricating the face only

Fig. 3-153



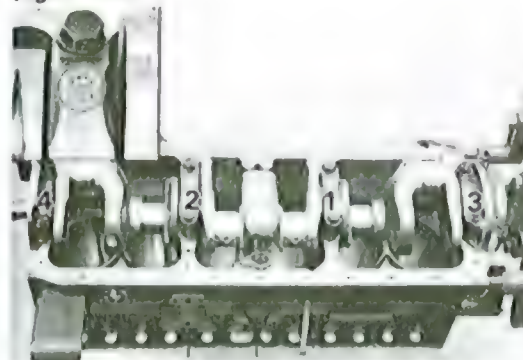
The oil holes of the front (No. 1) and rear (No. 4) bearings must be positioned toward the cylinder block side

Fig. 3-154



Before installing the front (No. 1) and rear (No. 4) bearing caps, coat liquid sealer to the areas indicated in the figure

Fig. 3-155

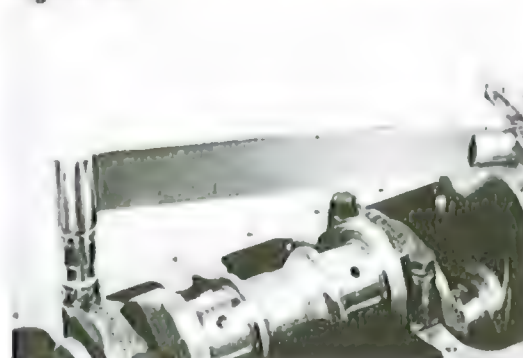


Tighten each bearing cap bolt a little at a time in the sequence shown in the figure

— Note —

Face the mark toward the front.

Fig. 3-156

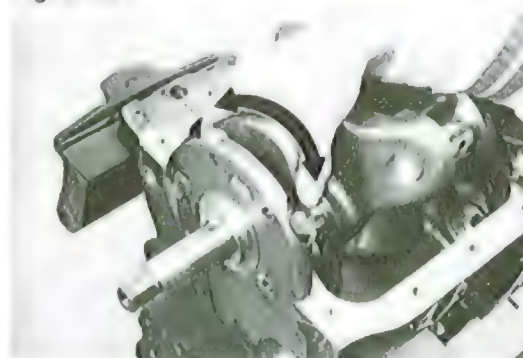


Tighten the bearing caps to specified torque

Tightening torque:

No. 1 — No. 3	12.5 — 15.0 kg-m (91 — 108 ft-lb)
No. 4	10.5 — 13.0 kg-m (76 — 94 ft-lb)

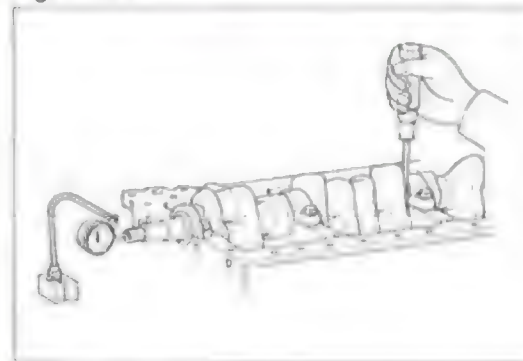
Fig. 3-157



— Note —

Check for tightness of crankshaft rotation after each time a bearing cap is tightened.

Fig. 3-158

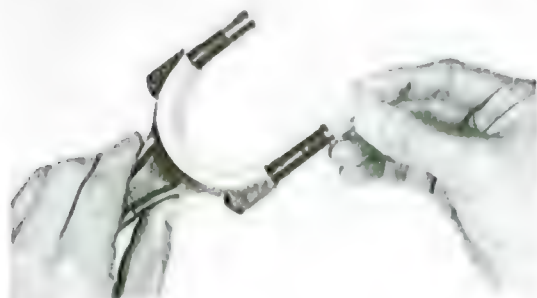


Measure the crankshaft thrust clearance

Thrust clearance:

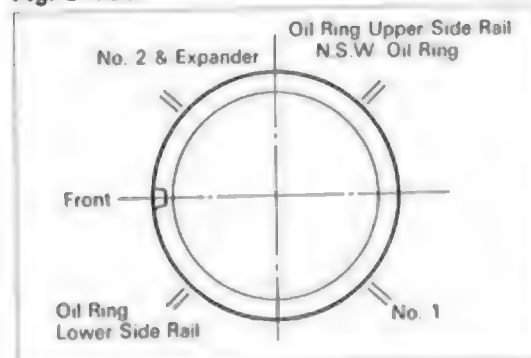
STD	0.06 — 0.16 mm (0.0024 — 0.0063 in.)
Limit	0.3 mm (0.012 in.)

Fig. 3-159



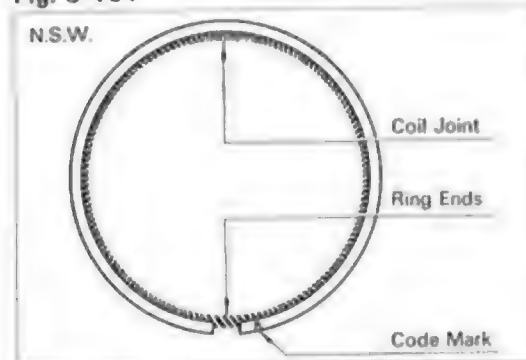
Cover the rod bolts with a hose to protect the crank pins from damage

Fig. 3-160



Position the ring gap in the direction shown in the figure

Fig. 3-161



(N.S.W.)
The oil ring ends should be at the opposite side of the expander coil joint.

Fig. 3-162



Assemble matching numbered piston/rod assemblies with the notch on the piston and the \oplus mark on the connecting rod facing the rear

Fig. 3-163



Insert the piston into the cylinder while compressing rings with a piston ring compressor

— Note —

Be careful not to break the piston ring.

Fig. 3-164



Align the marks on the rod and cap, and fit on the cap

Fig. 3-165



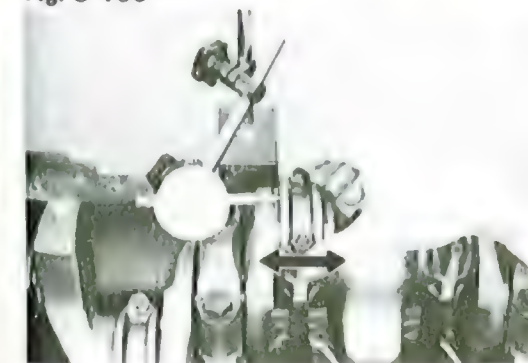
Tighten the connecting rod cap to specified torque

Tightening torque: 4.8 – 7.6 kg-m
(35 – 54 ft-lb)

— Note —

Check for tightness of crankshaft rotation after tightening each bearing.

Fig. 3-166

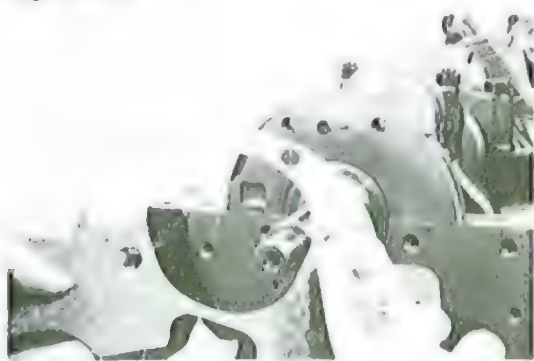


Check the connecting rod thrust clearance

Thrust clearance:

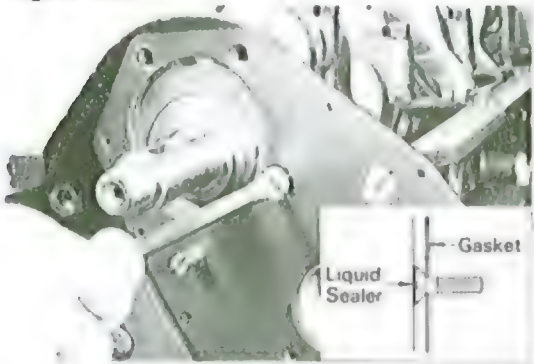
STD	0.08 – 0.24 mm (0.0031 – 0.0094 in.)
Limit	0.3 mm (0.012 in.)

Fig. 3-167



Apply liquid sealer onto both surfaces of the end plate gasket

Fig. 3-168

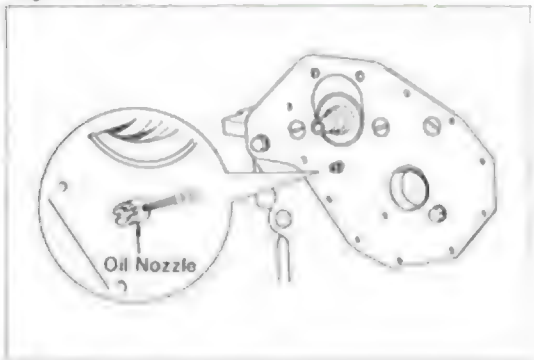


Correctly position the end plate by tightening the undercut flat head screws. Then tighten the bolts.

— Note —

Stake the end plate to fix the screws and apply liquid sealer on the head of them.

Fig. 3-169



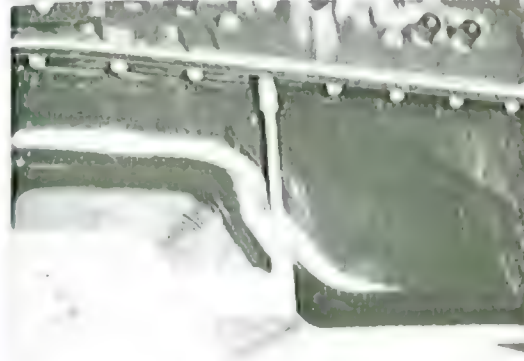
Make sure that the oil nozzle faces in the direction indicated in the figure and then stake the end plate at two places

Fig. 3-170



Apply liquid sealer to the cylinder block and gear cover as shown in the figure.

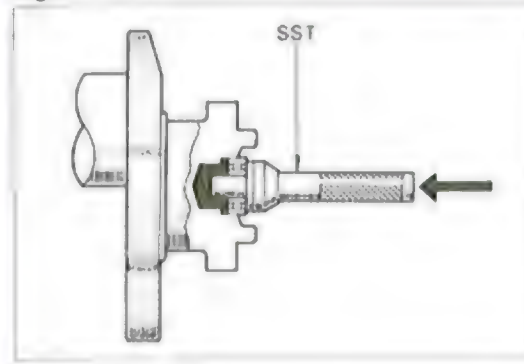
Fig. 3-171



Install the oil pan

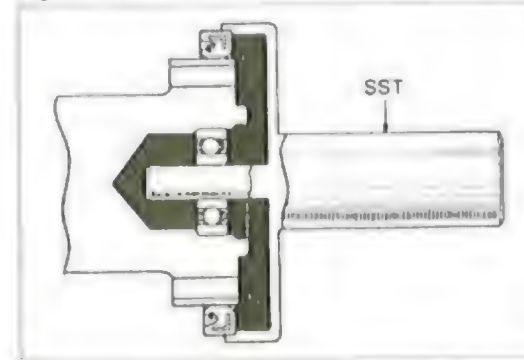
Tightening torque: 0.6 – 1.2 kg-m
(53 – 104 in.-lb)

Fig. 3-172



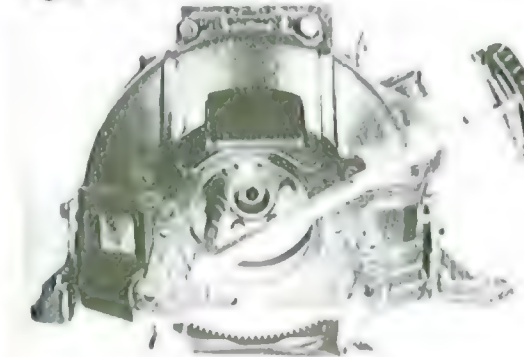
Drive in the input shaft bearing with SST
SST [09304-47010]

Fig. 3-173



Using SST, apply MP grease onto the oil seal lip and install the oil seal
SST [09223-60010]

Fig. 3-174



Tighten the bolts to specified torque.

Tightening torque: 8.0 – 11.0 kg-m
(58 – 79 ft-lb)

— Note —

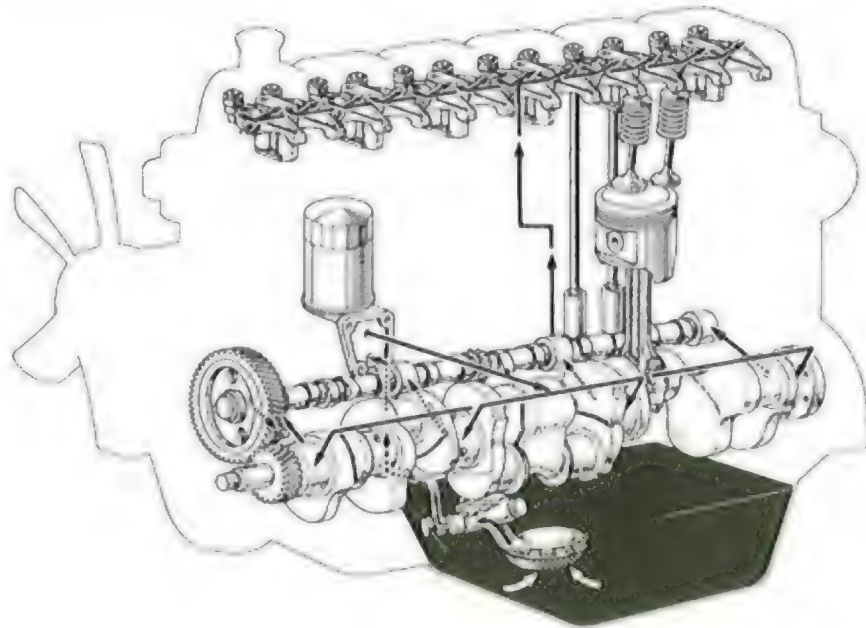
Apply a light coat of engine oil on the bolt threads and under the bolt head before installing.

LUBRICATION SYSTEM

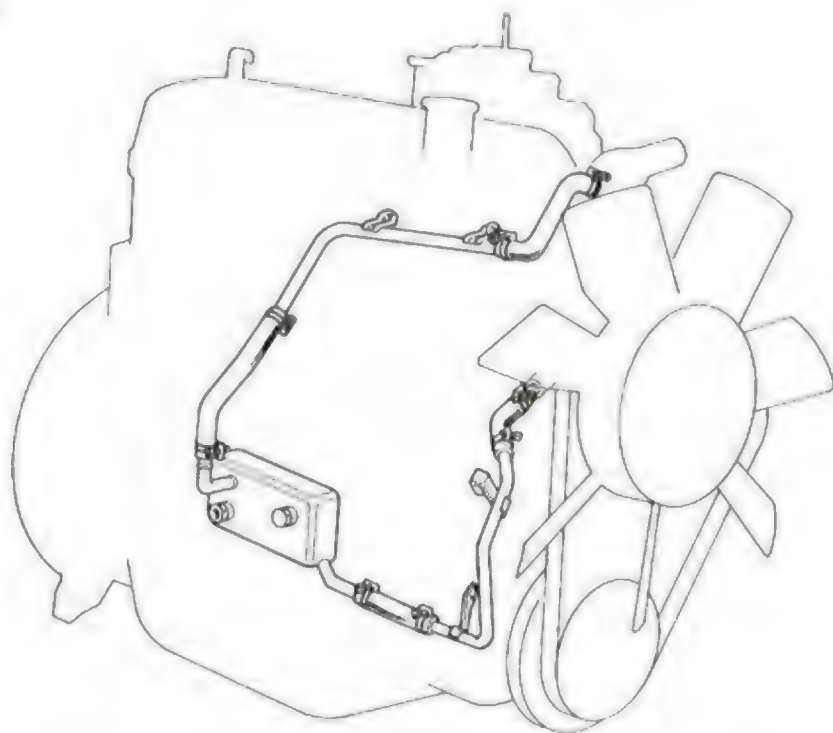
	Page
LUBRICATION SYSTEM CIRCUIT	4-2
OIL PUMP	4-3

LUBRICATION SYSTEM CIRCUIT

Fig. 4-1



Oil Cooler



OIL PUMP

DISASSEMBLY

Disassemble the parts in the numerical order shown in the figure.

Fig. 4-2

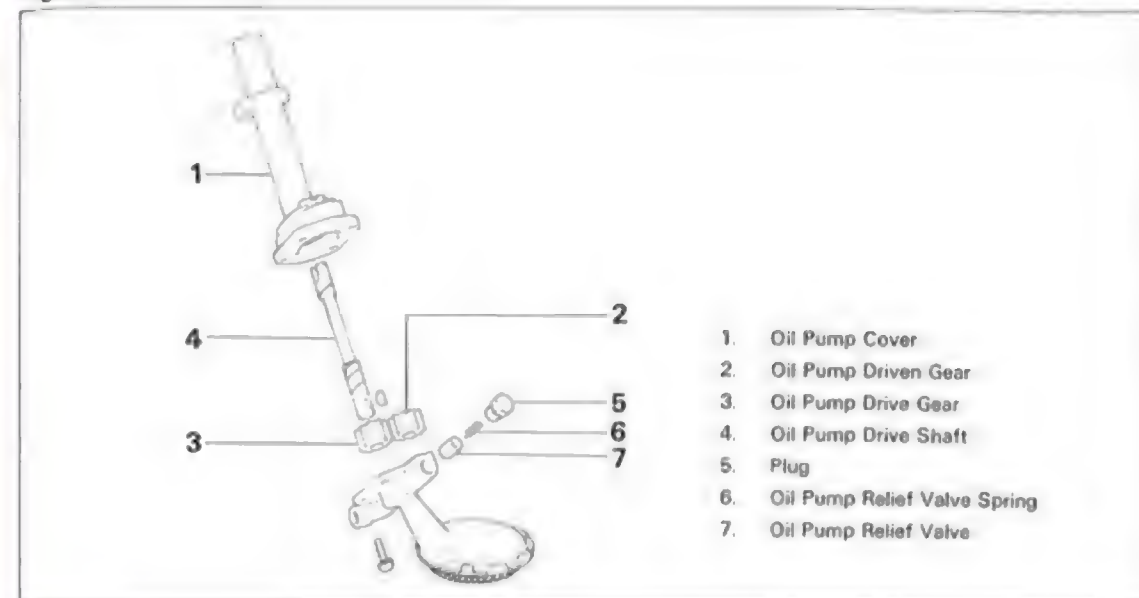
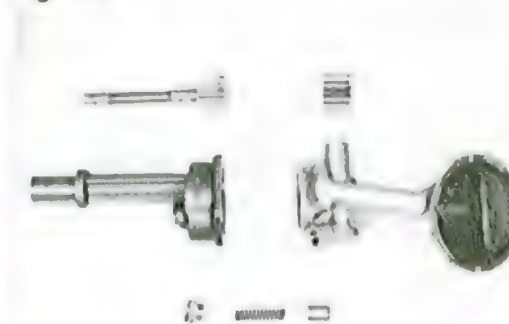


Fig. 4-3



INSPECTION

1. Check the disassembled parts for wear or damage.

Fig. 4-4



2. Check the relief valve for wear or scoring and check that it slides smoothly.

Fig. 4-5



3. Measure the tip clearance. If it exceeds the limit, replace the gear and/or pump body.

Tip clearance:

STD	0.11 – 0.18 mm (0.0043 – 0.0071 in.)
Limit	0.2 mm (0.008 in.)

Fig. 4-6



4. Measure the backlash. If it exceeds the limit, replace both gears.

Backlash:

STD	0.5 – 0.6 mm (0.020 – 0.024 in.)
Limit	0.95 mm (0.0374 in.)

Fig. 4-7



5. Measure the side clearance. If it exceeds the limit, replace the gear and/or pump body.

Side clearance:

STD	0.03 – 0.09 mm (0.0012 – 0.0035 in.)
Limit	0.15 mm (0.0059 in.)

Fig. 4-8



6. Measure the pump cover wear. If it exceeds the limit, replace the pump cover.

Wear limit: 0.15 mm
(0.0059 in.)

— Note —

Hold the oil pump cover in a soft jaw vise.

Fig. 4-9



REPLACEMENT

If necessary, replace the oil pump drive gear referring to the following procedures.

- Using SST and press, press out the drive gear.
SST [09236-28011]
[09236-36010]

Fig. 4-10



- Press in a new drive gear.

ASSEMBLY

Assemble the parts in the numerical order shown in the figure.

Fig. 4-11

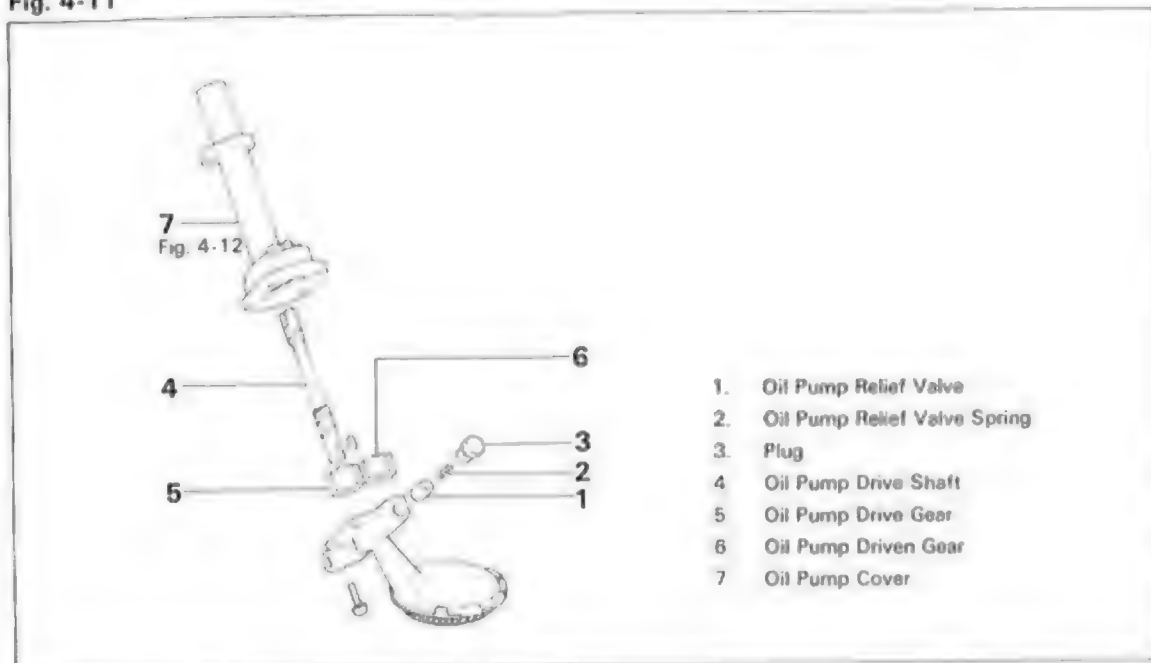


Fig. 4-12



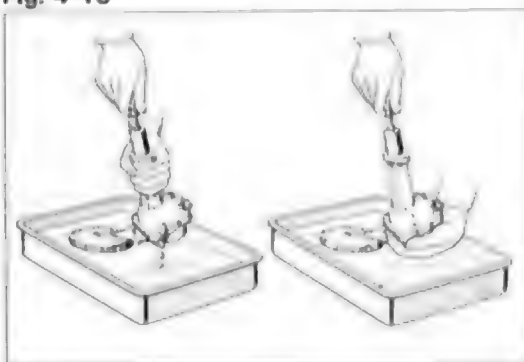
Install the pump cover, facing the discharge hole toward the pump body bolt hole.



Fig. 4-13

**CHECK PUMP OPERATION**

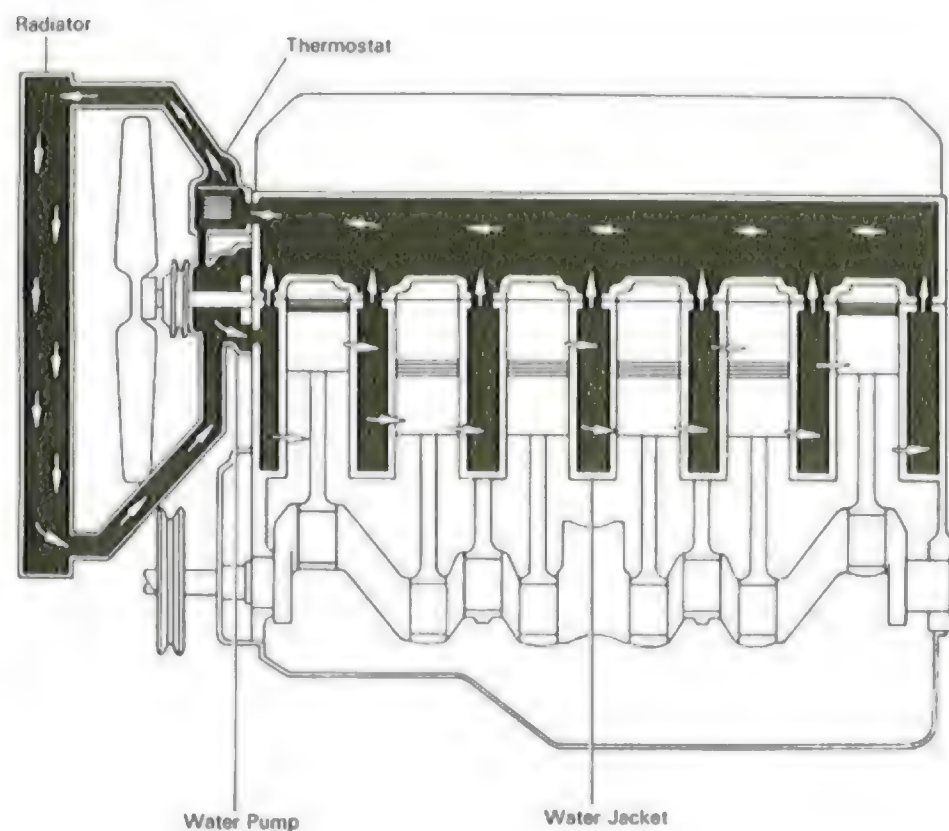
1. After assembly, immerse the pump suction end into clean engine oil, and turn the pump shaft clockwise with a screwdriver until oil comes out of the discharge hole.
2. Close the discharge hole with your thumb, and check to see if the pump shaft rotational resistance increases when turned further.

**COOLING SYSTEM**

	Page
COOLING SYSTEM CIRCUIT	5-2
WATER PUMP	5-3
RADIATOR	5-9
THERMOSTAT	5-9

COOLING SYSTEM CIRCUIT

Fig. 5-1



WATER PUMP

DISASSEMBLY

Disassemble the parts in the numerical order shown in the figure.

— Note —

If the water pump with coupling is faulty, replace the water pump assembly.

Fig. 5-2

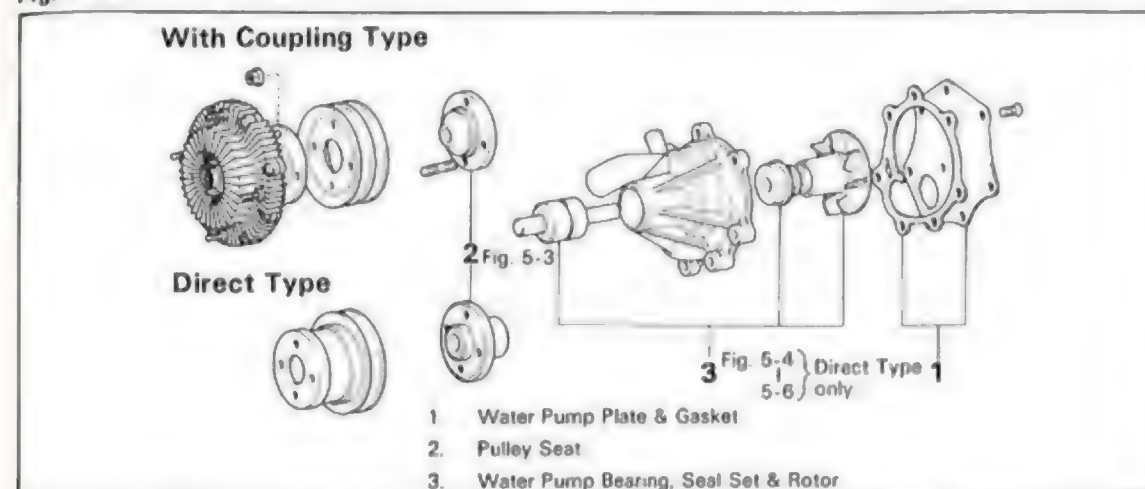
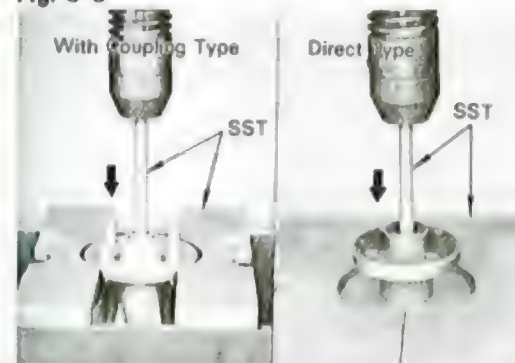


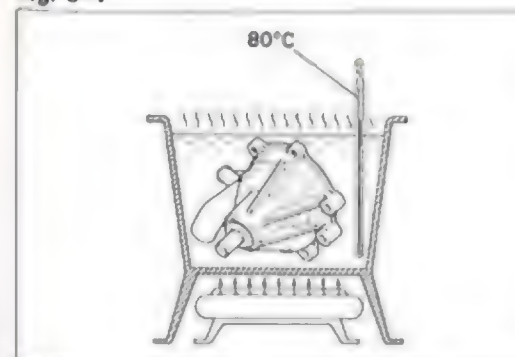
Fig. 5-3



While supporting the pulley seat, press out the shaft with SST.

SST [09236-36010] — With Coupling type
[09236-28011] — Direct type
[09236-36010]

Fig. 5-4



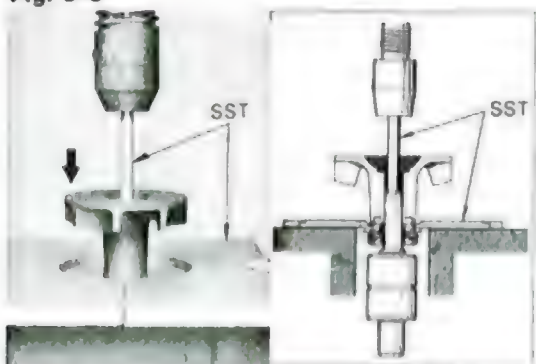
Heat the water pump body to about 80°C (176°F).

Fig. 5-5



Press out the bearing together with the rotor with SST.
SST [09236-28011]

Fig. 5-6



Press out the bearing with SST.
SST [09236-28011]

Fig. 5-7



INSPECTION

1. Inspect the disassembled parts for cracks, wear, damage and replace if defective.

Fig. 5-8



2. Inspect the bearing rotation. If damaged, produces noise or does not turn properly, replace it

Fig. 5-9



3. Check the fluid coupling for damage and silicone oil leak. If necessary, replace the coupling assembly.

— Note —
Do not press on the bi-metal.

ASSEMBLY

Assemble the parts in the numerical order shown in the figure.

Fig. 5-10

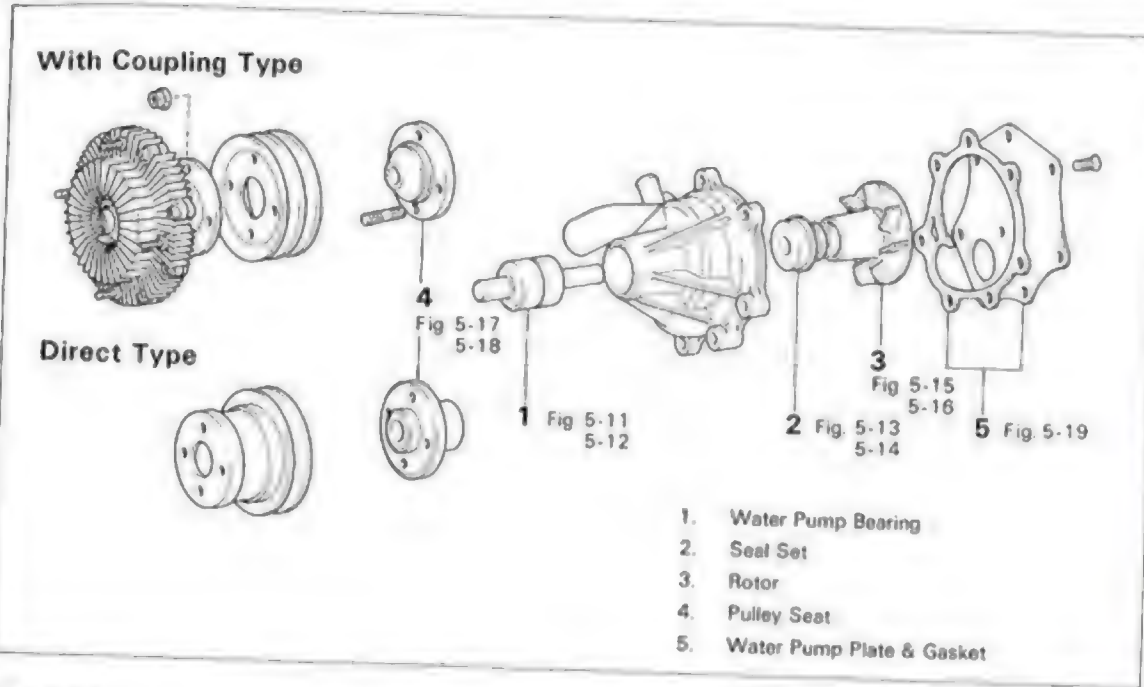
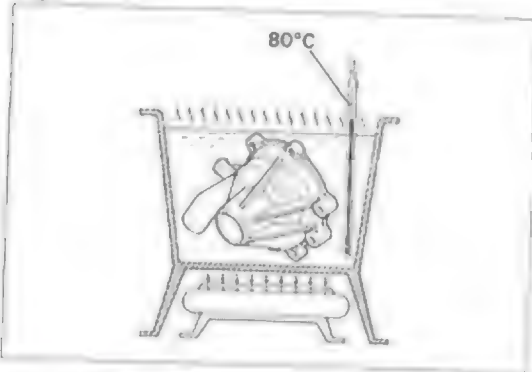
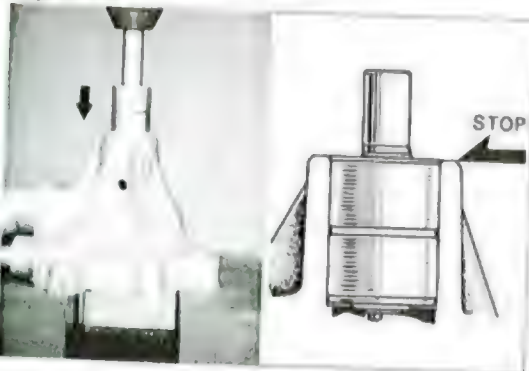


Fig. 5-11



Heat the water pump body to about 80°C (176°F).

Fig. 5-12



Press in the bearing.

— Note —

The bearing end face should be flush with the body top surface.

Fig. 5-13



Apply a little liquid sealer to the seal set.

— Note —

Always replace the seal set before re-assembly.

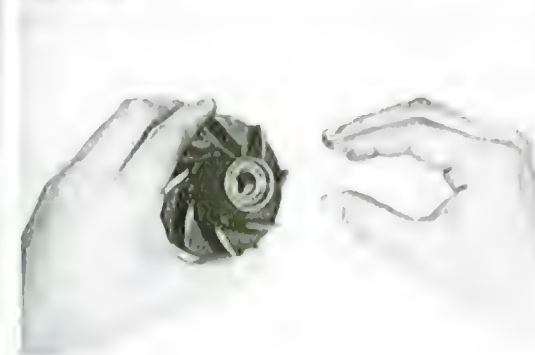
Fig. 5-14



Press the seal set into the pump body with SST.

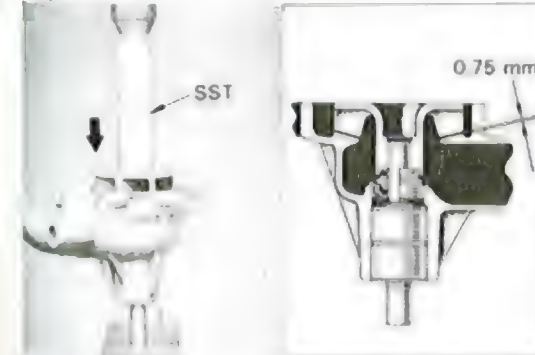
SST [09236-36010]

Fig. 5-15



Install the packing and seat into the rotor.

Fig. 5-16

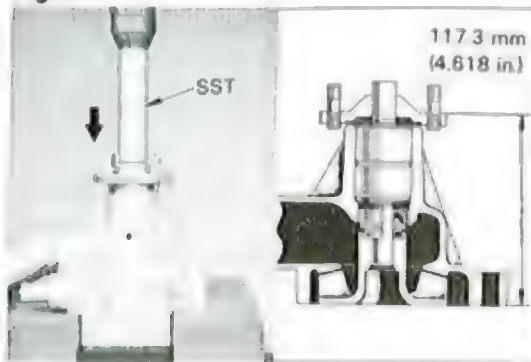


Press in the rotor with SST
SST [09236-36010]

— Note —

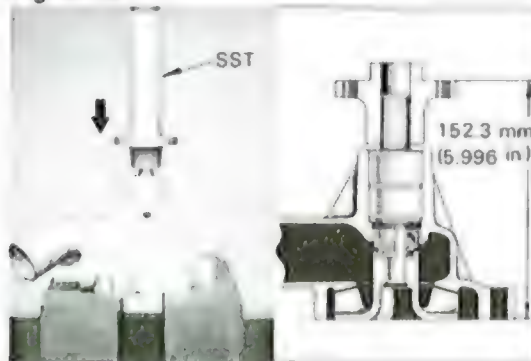
The gap between the pump body and rotor should be 0.75 mm (0.0295 in.).

Fig. 5-17



(With Coupling type)
Press in the pulley seat to the specified depth
with SST.
SST [09236-28011]

Fig. 5-18



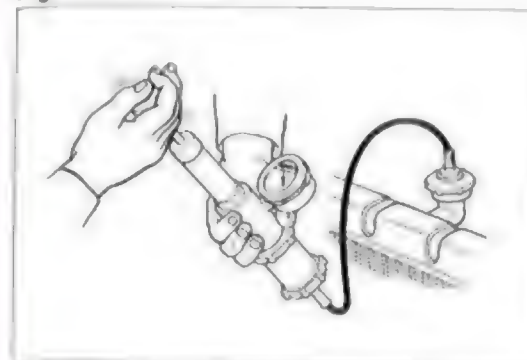
(Direct type)
Press in the pulley seat to the specified depth
with SST.
SST [09236-36010]

Fig. 5-19



After assembly, make sure the rotor rotates
smoothly.

Fig. 5-20



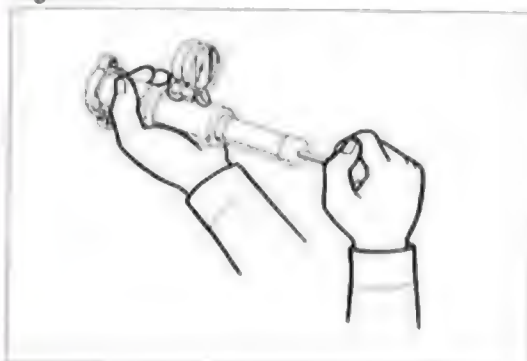
RADIATOR INSPECTION

1. Install the radiator cap tester to the radiator, apply pressure and check for leakage in the cooling system under normal operating temperature.

Applicable pressure:

1.5 kg/cm²
(21 psi)

Fig. 5-21



2. Check the pressure sealing and vacuum relief valve operation

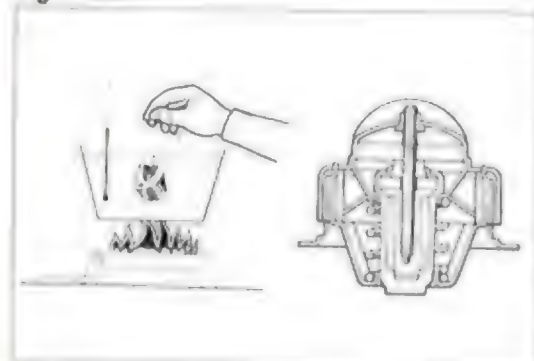
Valve opening pressure:

STD 0.75 – 1.05 kg/cm²
(10.7 – 14.9 psi)

Limit 0.6 kg/cm²
(8.5 psi)

3. If the readings are not within acceptable limits, replace the radiator cap

Fig. 5-22

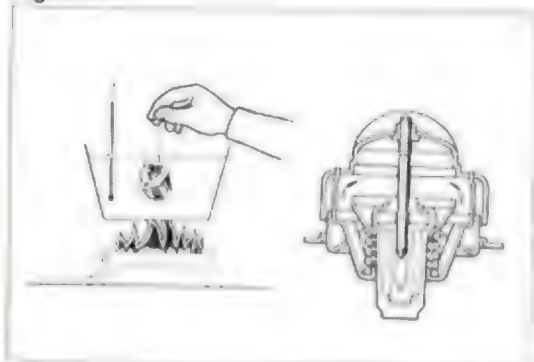


THERMOSTAT INSPECTION

1. Immerse the thermostat in water, and check the valve opening temperature by gradually heating the water.
2. Replace the thermostat if the valve remains open at normal temperature or is not very tight when fully closed

Valve starts to open at 86 – 90°C
(187 – 194°F).

Fig. 5-23



Valve opens by more than 10 mm
(0.39 in.) at 100°C (212°F).

FUEL SYSTEM

	Page
FUEL PUMP	6-2
CARBURETOR (USA)	6-4
(General Countries)	6-27
CARBURETOR ADJUSTMENT	6-50

Fig. 6-1



FUEL PUMP



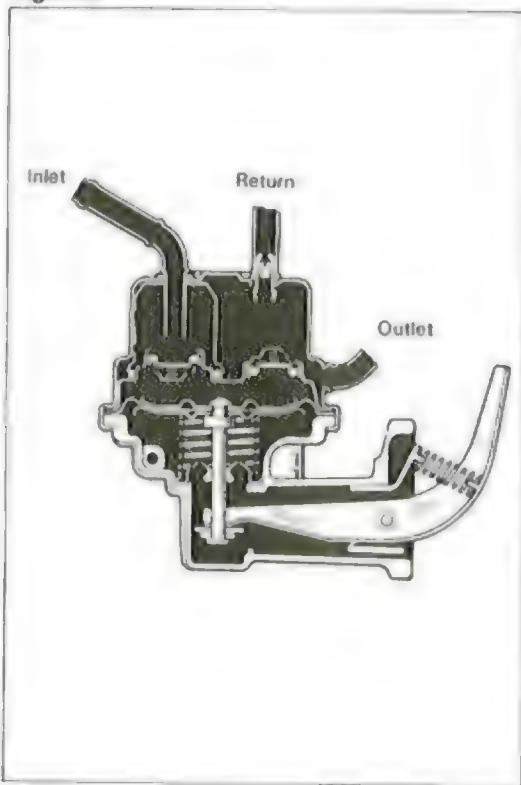
REMOVAL

After disconnecting the fuel hoses, remove the fuel pump.

— Note —

Be sure to plug the ends of the fuel hoses.

Fig. 6-2



PRECHECK

1. Run some fuel through the pump to insure that the check valves seal tightly.

— Note —

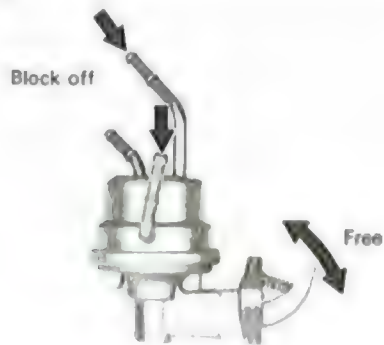
A dry check valve may not seal properly.

2. Without blocking off any pipes, operate the pump lever and check the amount of force necessary for operation and the amount of arm play.

— Note —

This same amount of force should be used in the following checks.

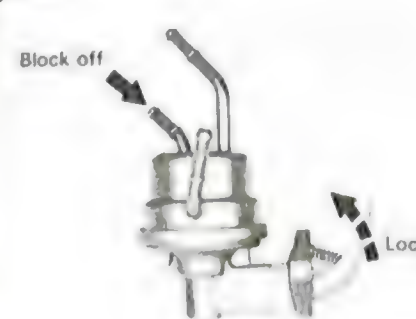
Fig. 6-3



INSPECTION

1. Block off the outlet pipes with your finger and check that there is an increase in lever arm play and that the lever arm moves freely.

Fig. 6-4

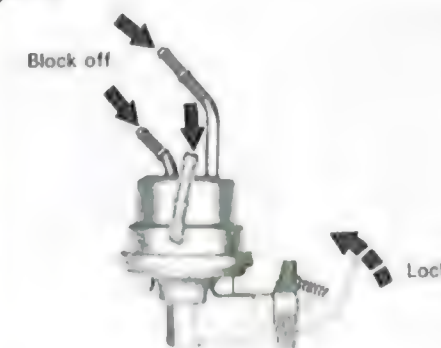


2. Block off the inlet pipe with your finger and check that the pump arm locks.

— Note —

Do not use more force than that used in the PRECHECK.

Fig. 6-5

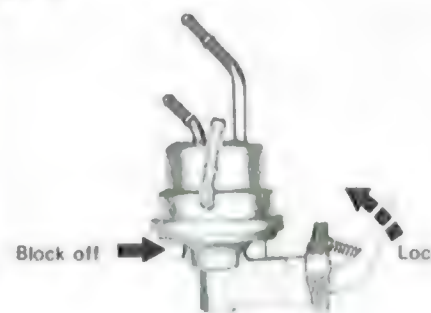


3. Block off the inlet and outlet pipes and check that the pump arm locks.

— Note —

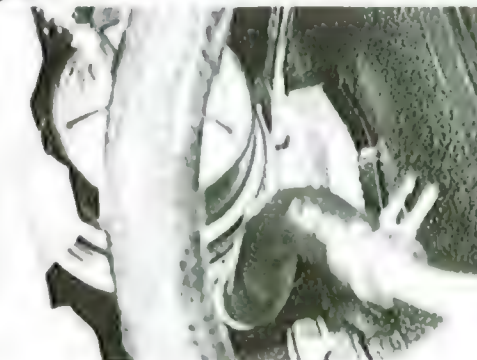
If all three checks mentioned above are not as specified, the caulking of the body and upper casing is faulty.

Fig. 6-6



4. Block off the vent hole with your finger and check that the pump arm locks.

Fig. 6-7



INSTALLATION

After installing the fuel pump, connect the fuel hoses.

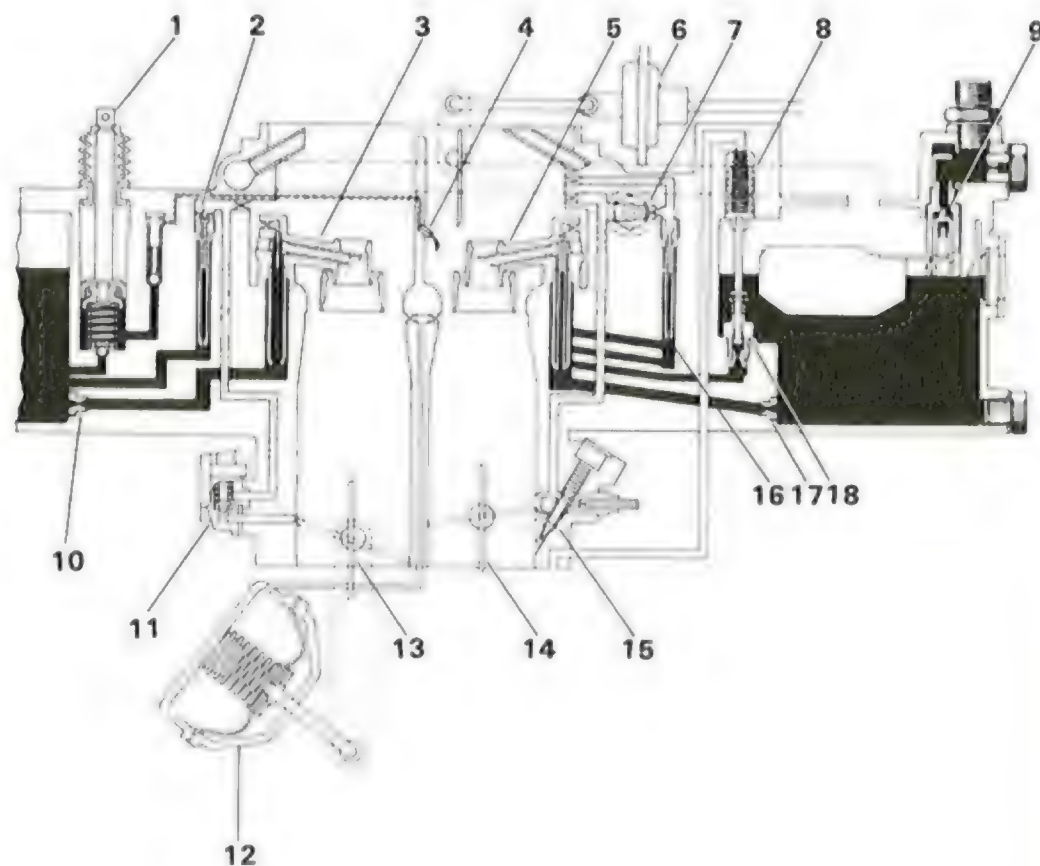
— Note —

After connecting the fuel hoses, start the engine and check for fuel leaks.

CARBURETOR (USA)

CARBURETOR CIRCUIT

Fig. 6-8



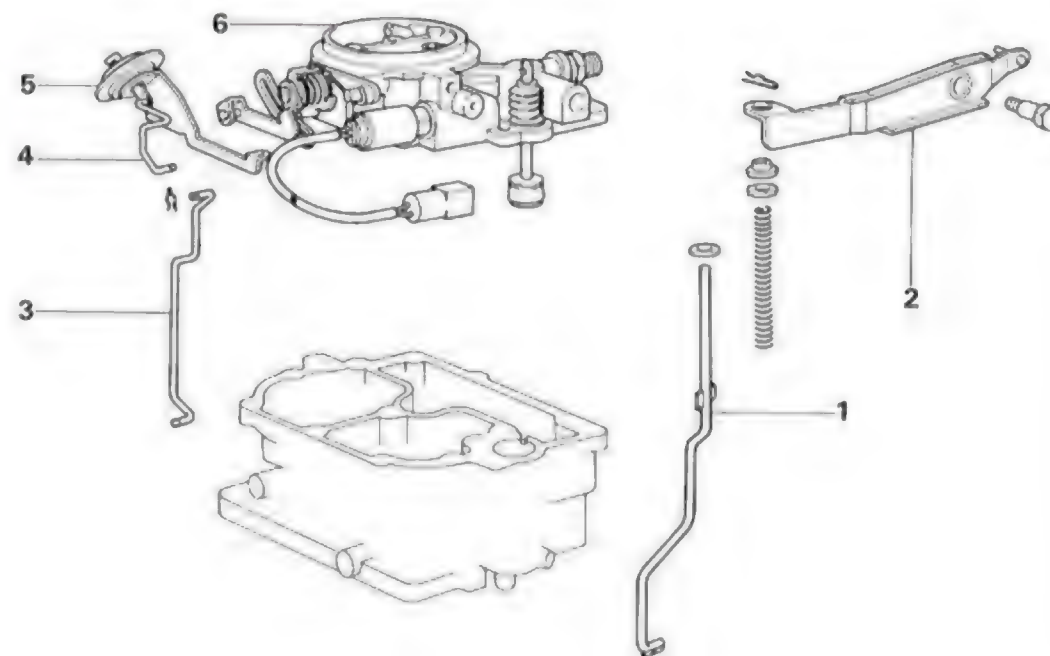
- | | |
|--------------------|----------------------------------|
| 1. Pump Plunger | 10. 2nd Main Jet |
| 2. 2nd Slow Jet | 11. Slow Cut Valve |
| 3. 2nd Main Nozzle | 12. Diaphragm |
| 4. Pump Jet | 13. 2nd Throttle Valve |
| 5. 1st Main Nozzle | 14. 1st Throttle Valve |
| 6. Choke Breaker | 15. Idle Mixture Adjusting Screw |
| 7. Solenoid Valve | 16. 1st Slow Jet |
| 8. Power Piston | 17. 1st Main Jet |
| 9. Needle Valve | 18. Power Valve |

DISASSEMBLY

Air Horn

Disassemble the parts in the numerical order shown in the figure.

Fig. 6-9



- | |
|----------------------------------|
| 1. Pump Connecting Link |
| 2. Pump Arm |
| 3. Fast Idle Connecting Link |
| 4. Choke Breaker Connecting Link |
| 5. Choke Breaker |
| 6. Air Horn with Gasket |

Float

Disassemble the parts in the numerical order shown in the figure.

Fig. 6-10

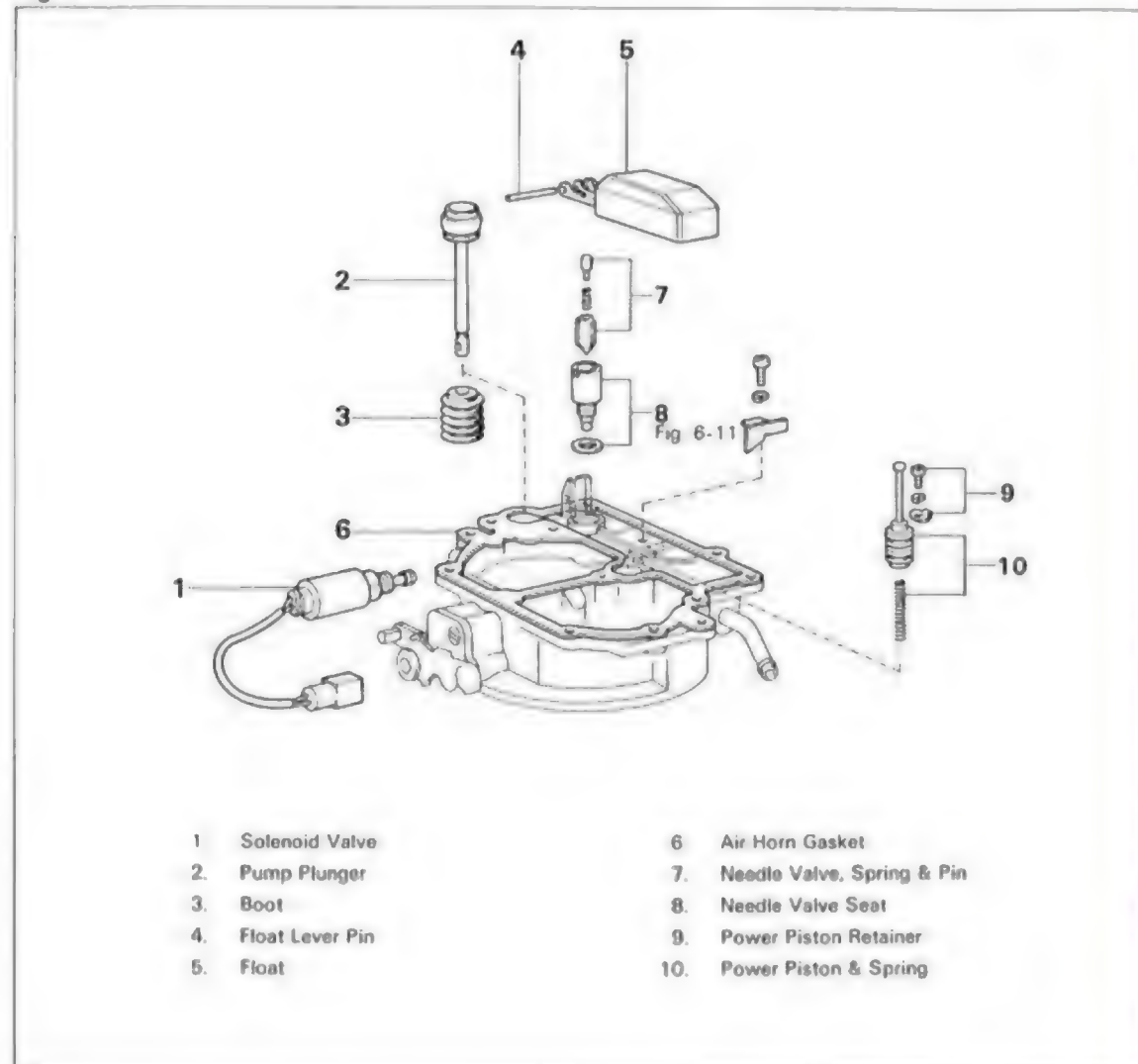
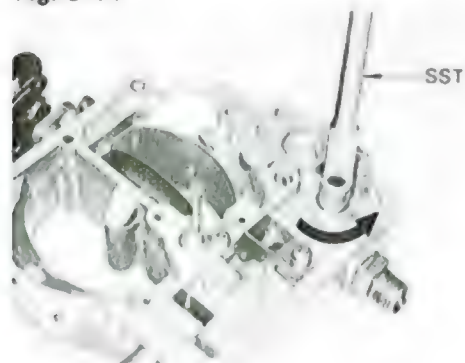


Fig. 6-11



Remove the needle valve seat with SST.
SST [09860-11011]

Choke System

Disassemble the parts in the numerical order shown in the figure.

Fig. 6-12

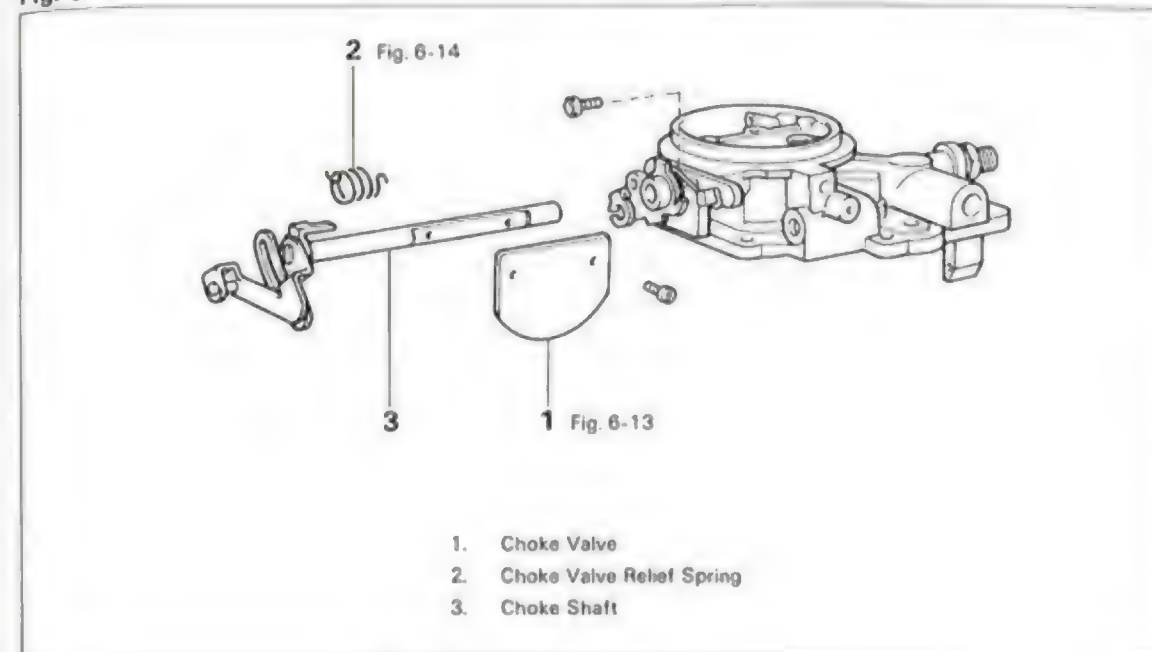
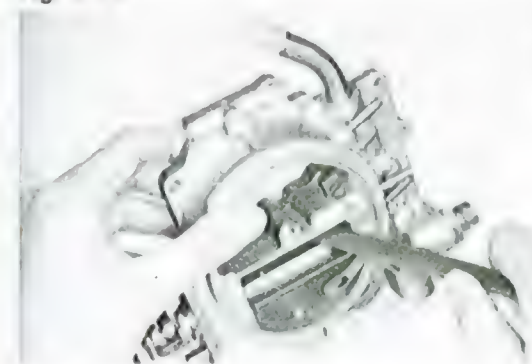


Fig. 6-13



To remove the choke valve, file off the ends of the set screws.

— Note —

Do this only if it is necessary to replace the choke shaft.

Fig. 6-14

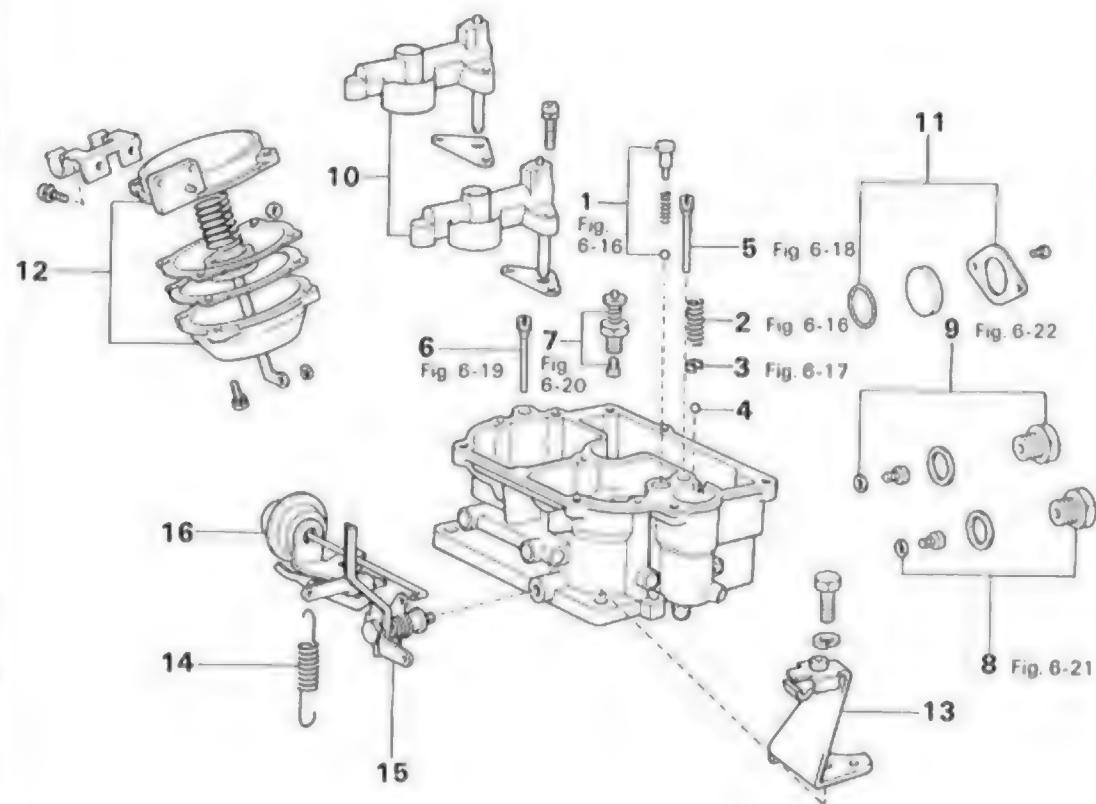


Unhook the choke valve relief spring and pull out the choke shaft.

Body

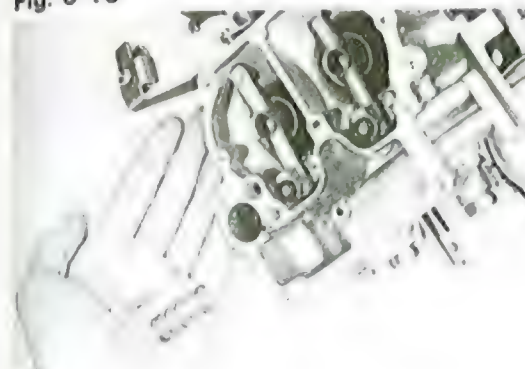
Disassemble the parts in the numerical order shown in the figure.

Fig. 6-15



- | | |
|---|------------------------------------|
| 1. Steel Ball for Discharge Weight & Spring | 9. 2nd Main Jet |
| 2. Pump Damping Spring | 10. Small Venturi |
| 3. Check Ball Retainer | 11. Level Gauge Glass |
| 4. Steel Ball for Pump Plunger | 12. Diaphragm |
| 5. 1st Slow Jet | 13. Choke Wire Clamp |
| 6. 2nd Slow Jet | 14. Back Spring for Throttle Shaft |
| 7. Power Valve | 15. Choke Opener Connecting Arm |
| 8. 1st Main Jet | 16. Choke Opener |

Fig. 6-16

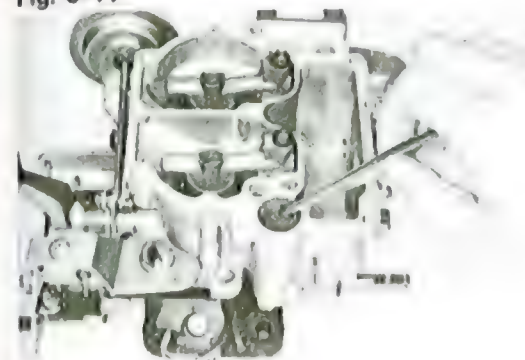


Drop out the steel ball for the discharge weight and springs.

— Note —

Be careful not to lose the steel ball.

Fig. 6-17

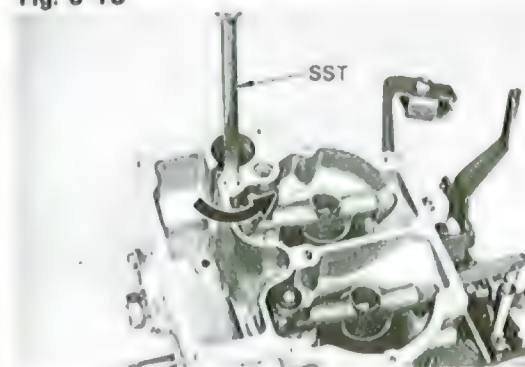


Remove the check ball retainer with a pair of tweezers and then remove the steel ball for pump plunger.

— Note —

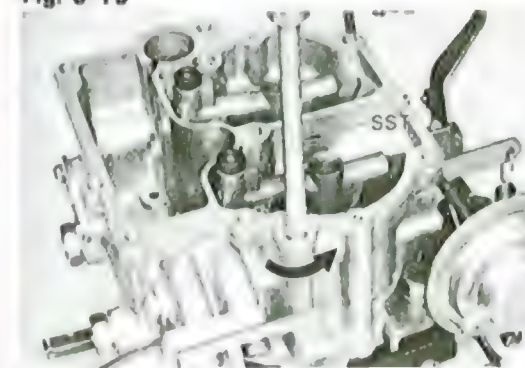
Be careful not to lose the steel ball.

Fig. 6-18



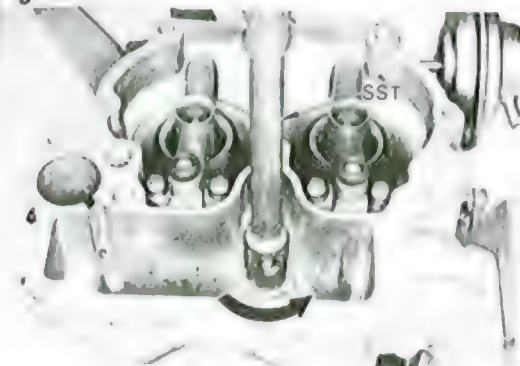
Remove the 1st slow jet with SST.
SST [09860-11011]

Fig. 6-19



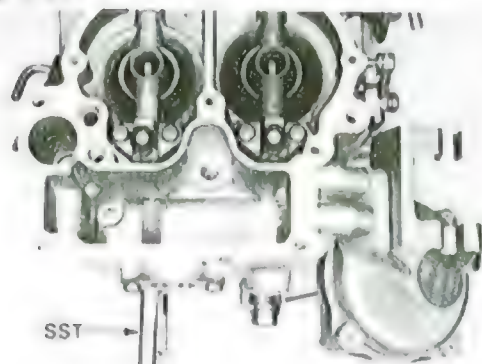
Remove the 2nd slow jet with SST.
SST [09860-11011]

Fig. 6-20



Remove the power valve with SST.
SST [09860-11011]

Fig. 6-21



Remove the 1st main jet with SST.
SST [09860-11011]

Fig. 6-22



Remove the 2nd main jet with SST.
SST [09860-11011]

Flange

Disassemble the parts in the numerical order shown in the figure

Fig. 6-23

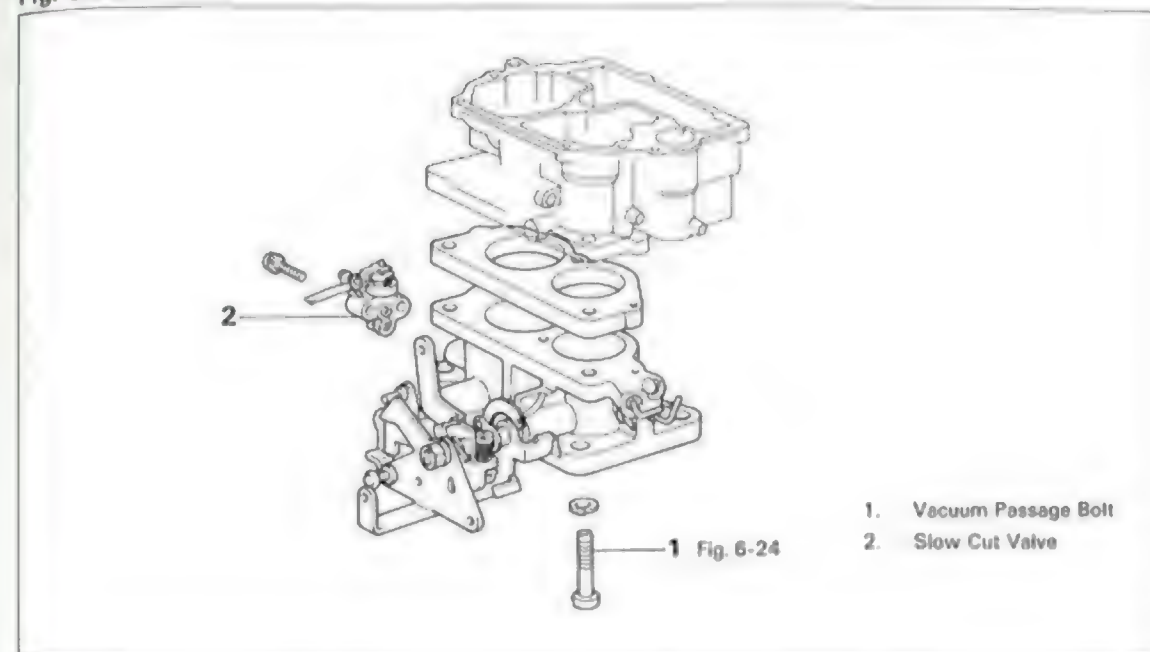
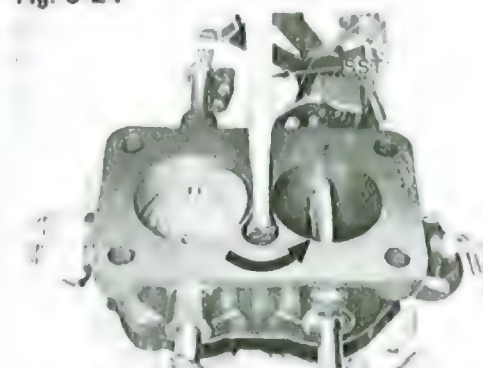


Fig. 6-24



Remove the vacuum passage bolt with SST.
SST [09860-11011]

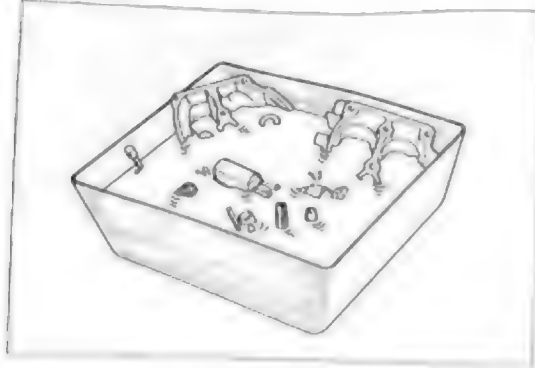
Fig. 6-25

SEE
FUEL SYSTEM
ADJUSTMENT SECTION
Figs. 6-163 to 6-175

The idle mixture adjusting screw is adjusted and plugged with a steel plug by the manufacturer.

If necessary, remove the steel plug and adjust the idle mixture speed referring to CARBURETOR ADJUSTMENT section

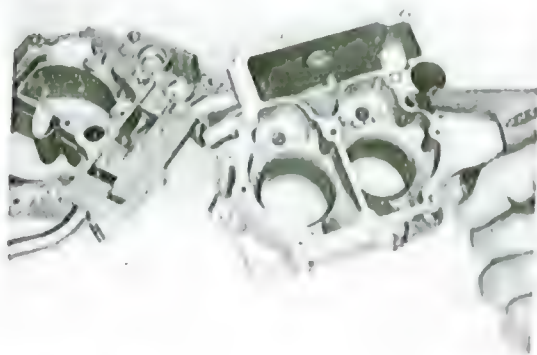
Fig. 6-26

**INSPECTION**

— Precaution —

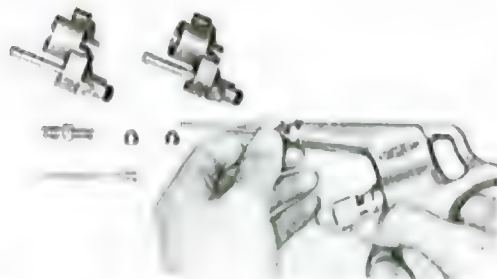
1. Before inspection, wash all parts thoroughly with gasoline.

Fig. 6-27



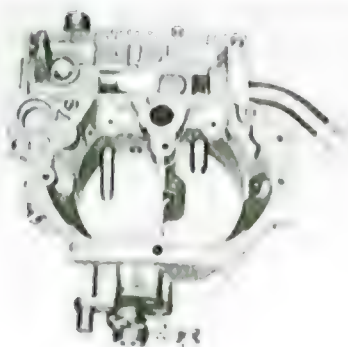
2. Using compressed air, blow all dirt and other foreign matter from the jets and similar parts, and from the fuel passages and apertures in the body.

Fig. 6-28



3. Never clean the jets or orifices with wire or a drill. This could enlarge the openings and result in excessive fuel consumption.

Fig. 6-29



Inspect the following parts and replace any part damaged.

Air Horn Parts

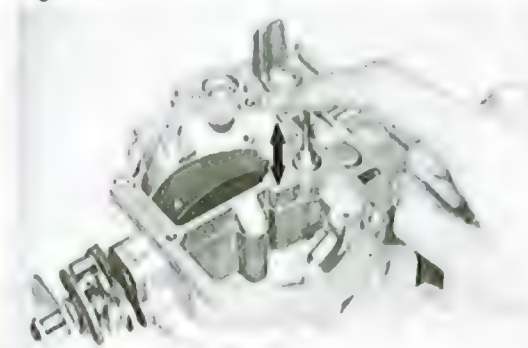
1. Air horn: Check for cracks, damaged threads and wear on choke shaft bores.

Fig. 6-30



2. Power piston: Check for damage.
Spring: Check for deformation or rust.
Power piston bore: Check for wear or damage.

Fig. 6-31



3. Make sure that the power piston moves smoothly in the air horn bore.

Fig. 6-32



4. Float and float lever pin: Check for wear or breaks.

Fig. 6-33



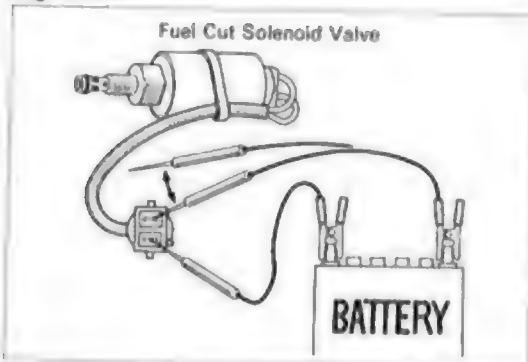
5. Strainer: Check for rust or breaks.
6. Needle valve surface.
7. Needle valve seat.

Fig. 6-34



8. Choke valve: Check for deformation.
Choke shaft: Check for wear, bending or improper fit in housing.

Fig. 6-35



9. Solenoid valve: Connect two terminals and battery as shown in the figure. Check that you can feel the click from the solenoid valve when the battery is connected and disconnected.

Fig. 6-36



10. Choke breaker: Apply vacuum to the diaphragm. Check that vacuum does not drop immediately and the link moves when vacuum is applied.

Fig. 6-37



11. Pump plunger: Check for wear on sliding surface and for damaged or deformed leather.
Boot: Check for damage.



Fig. 6-38

**Body Parts**

1. Body: Check for cracks, scored mounting surfaces and damaged threads.

Fig. 6-39



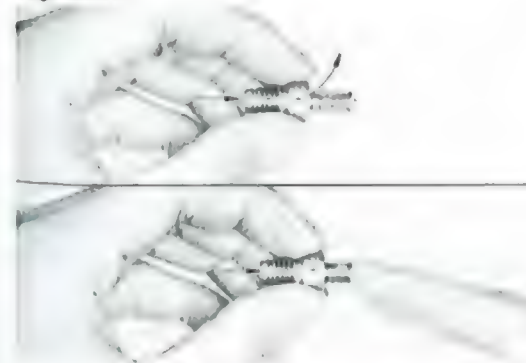
2. Small venturis: Check for damage or clogging.

Fig. 6-40



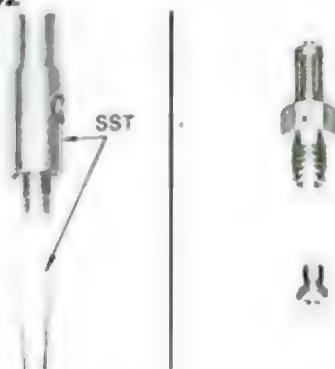
3. Jets: Check for damage or clogging. Check for damaged contact surface, threads and screwdriver slots.

Fig. 6-41



4. Power valve: Check for faulty opening and closing action. Check for damaged contact surface and threads.

Fig. 6-42



- 5 Remove the jet with SST.
SST [09860-11011]

Fig. 6-43



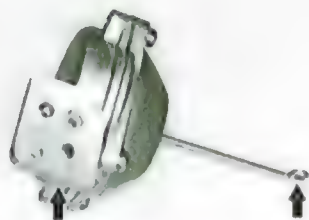
- 6 Pump damping spring: Check for deformation or rust.
Steel ball. Check for damage or rust.

Fig. 6-44



- 7 Diaphragm: Check the diaphragm, housing and spring for wear or damage.

Fig. 6-45



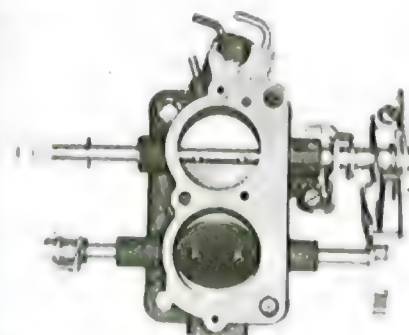
- 8 Assemble the diaphragm as shown in the figure.

Fig. 6-46



- 9 Choke opener: Apply vacuum to the diaphragm. Check that vacuum does not drop immediately and the link moves when vacuum is applied.

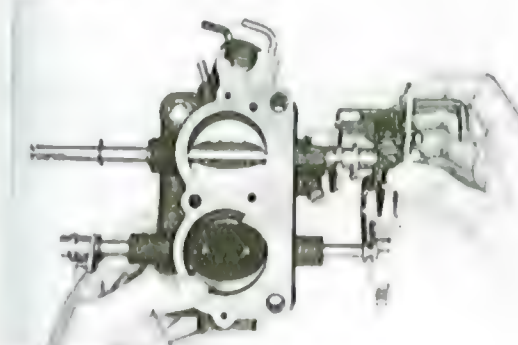
Fig. 6-47



Flange Parts

1. Flange: Check for cracks, damaged mounting surfaces, threads and for wear on throttle shaft bearings.

Fig. 6-48



2. Throttle valves: Check for worn or deformed valves and for wear, bending, twisting or faulty movement inside the housing shaft.

Fig. 6-49



3. Slow cut valve: Check the boot for damage. Make sure that the valve moves smoothly.

ASSEMBLY**Flange**

Assemble the parts in the numerical order shown in the figure.

Fig. 6-50

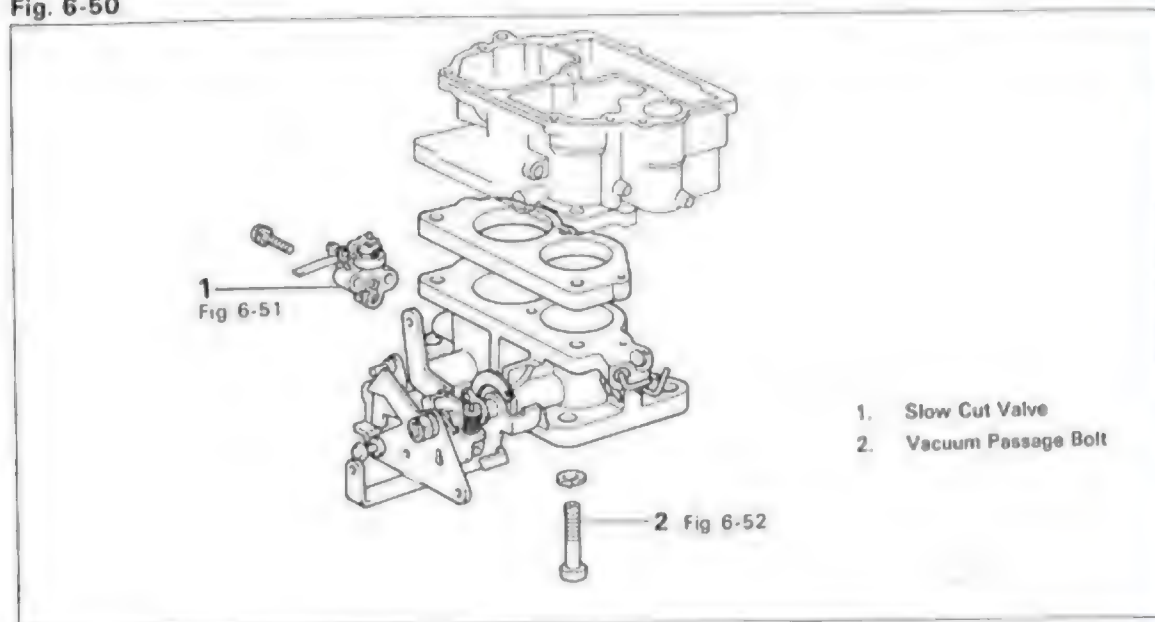
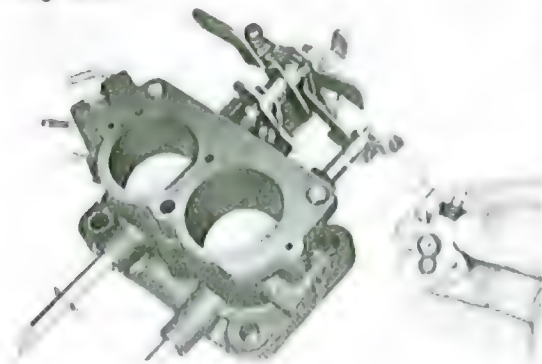


Fig. 6-51

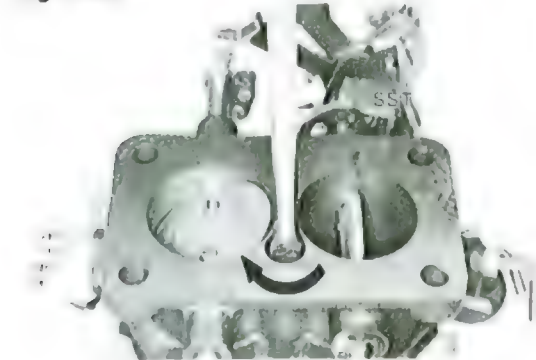


Install the slow cut valve.

— Note —

Before tightening the set bolts, confirm that the gasket is installed correctly.

Fig. 6-52



Tighten the vacuum passage bolt with SST, SST [09860-11011]

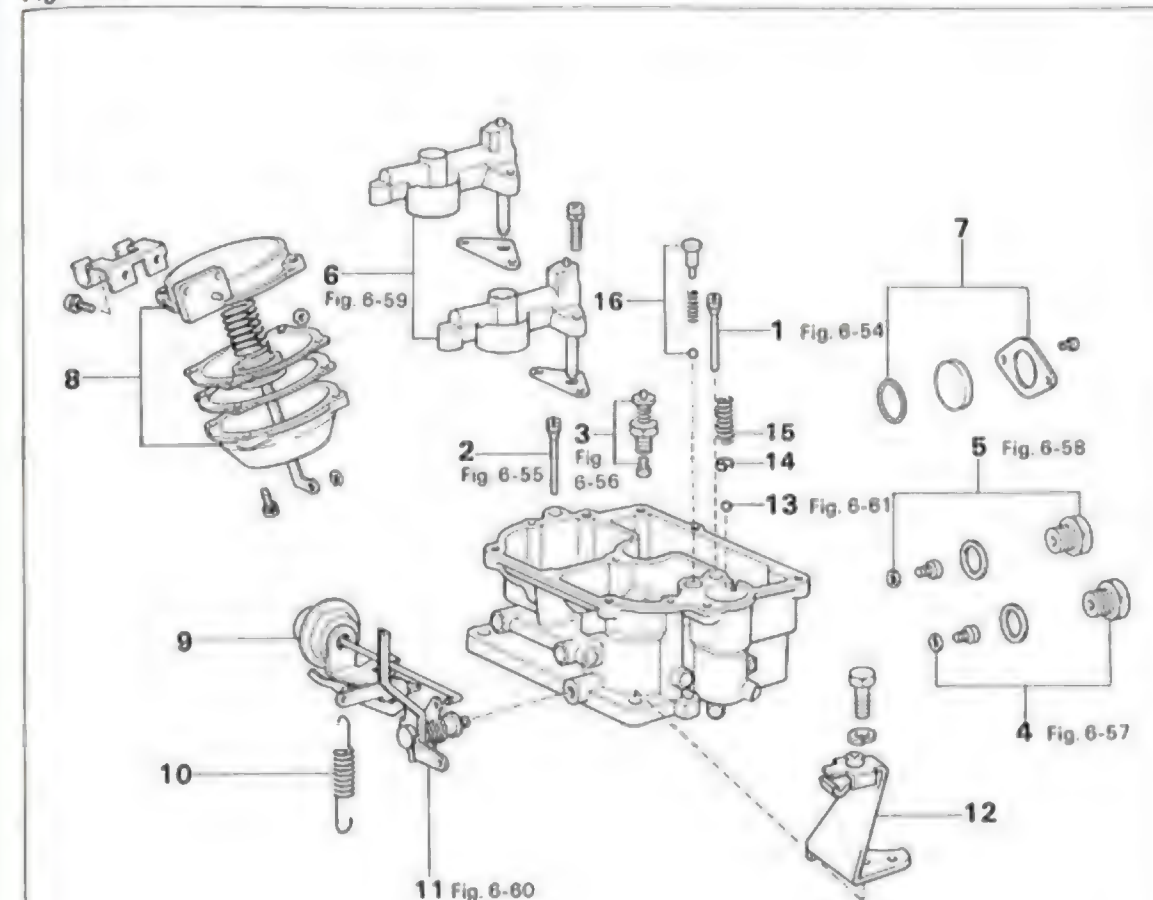
— Note —

Use a new gasket.

Body

Assemble the parts in the numerical order shown in the figure.

Fig. 6-53



1. 1st Slow Jet
2. 2nd Slow Jet
3. Power Valve
4. 1st Main Jet
5. 2nd Main Jet
6. Small Venturi
7. Level Gage Glass
8. Diaphragm

9. Choke Opener
10. Back Spring for Throttle Shaft
11. Choke Opener Connecting Arm
12. Choke Wire Clamp
13. Steel Ball for Pump Plunger
14. Check Ball Retainer
15. Pump Damping Spring
16. Steel Ball for Discharge Weight & Spring

Fig. 6-54



Install the 1st slow jet with SST
SST [09860-11011]

Fig. 6-55



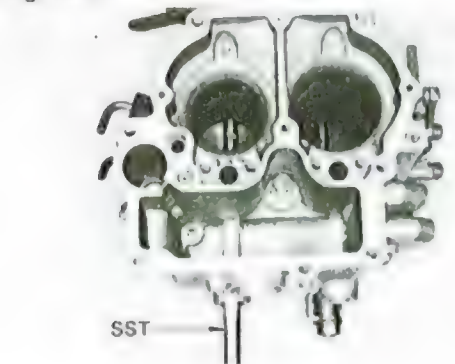
Install the 2nd slow jet with SST.
SST [09860-11011]

Fig. 6-56



Install the power valve with SST
SST [09860-11011]

Fig. 6-57

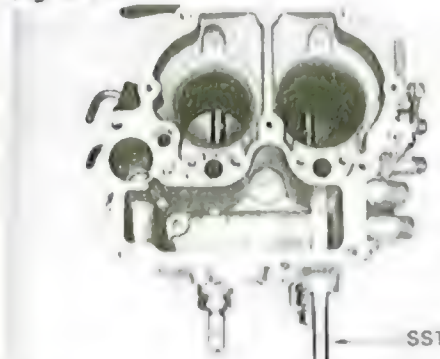


Install the 1st main jet with SST.
SST [09860-11011]

— Note —

The 1st main jet is brass colored.

Fig. 6-58

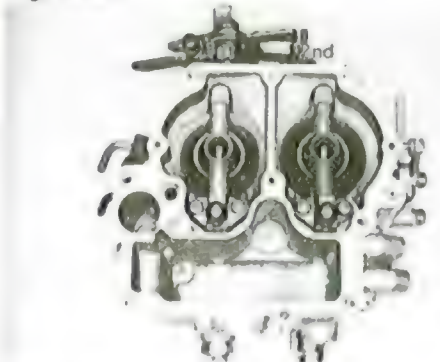


Install the 2nd main jet with SST
SST [09860-11011]

— Note —

The 2nd main jet is chrome colored.

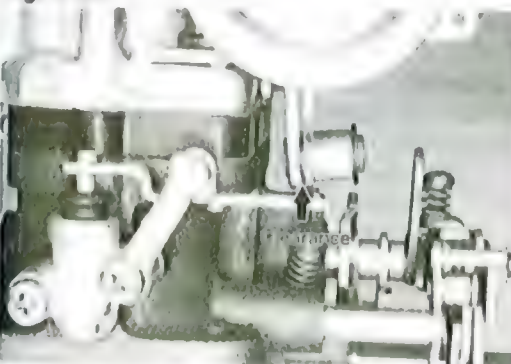
Fig. 6-59



Install the venturis.

1st small venturi — Chrome colored
2nd small venturi — Brass colored

Fig. 6-60

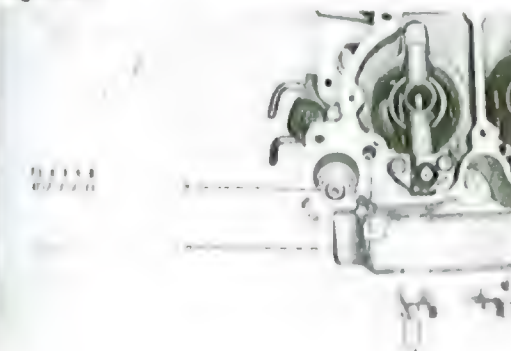


Select the fast throttle shaft shim to obtain the specified clearance at the point indicated in the figure

Clearance: 0.1 mm
(0.004 in.)

Shim thickness:
0.1, 0.2, 0.3, 0.6 mm
(0.004, 0.008, 0.012,
0.024 in.)

Fig. 6-61



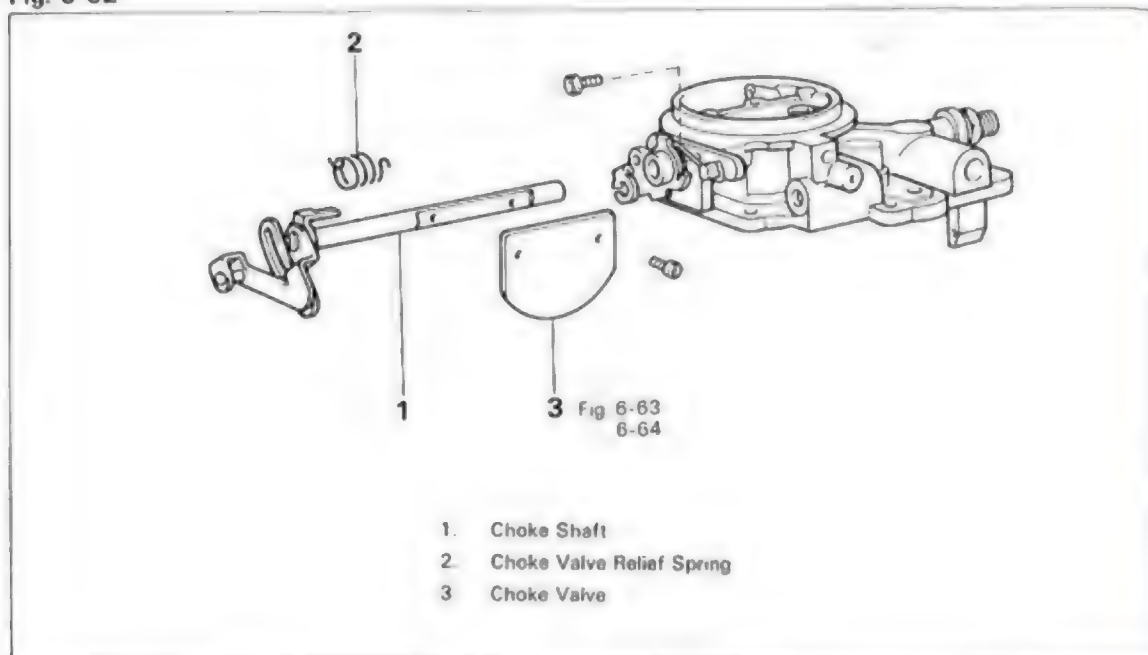
Install the steel balls, being careful not to mix up the two sizes of balls.

Smaller ball — For pump plunger
Larger ball — For discharge weight

Choke System

Assemble the parts in the numerical order shown in the figure.

Fig. 6-62



1. Choke Shaft
2. Choke Valve Relief Spring
3. Choke Valve

Fig. 6-63



Install the choke valve.

— Note —

Stake the choke shaft screws after assembling them.

Fig. 6-64

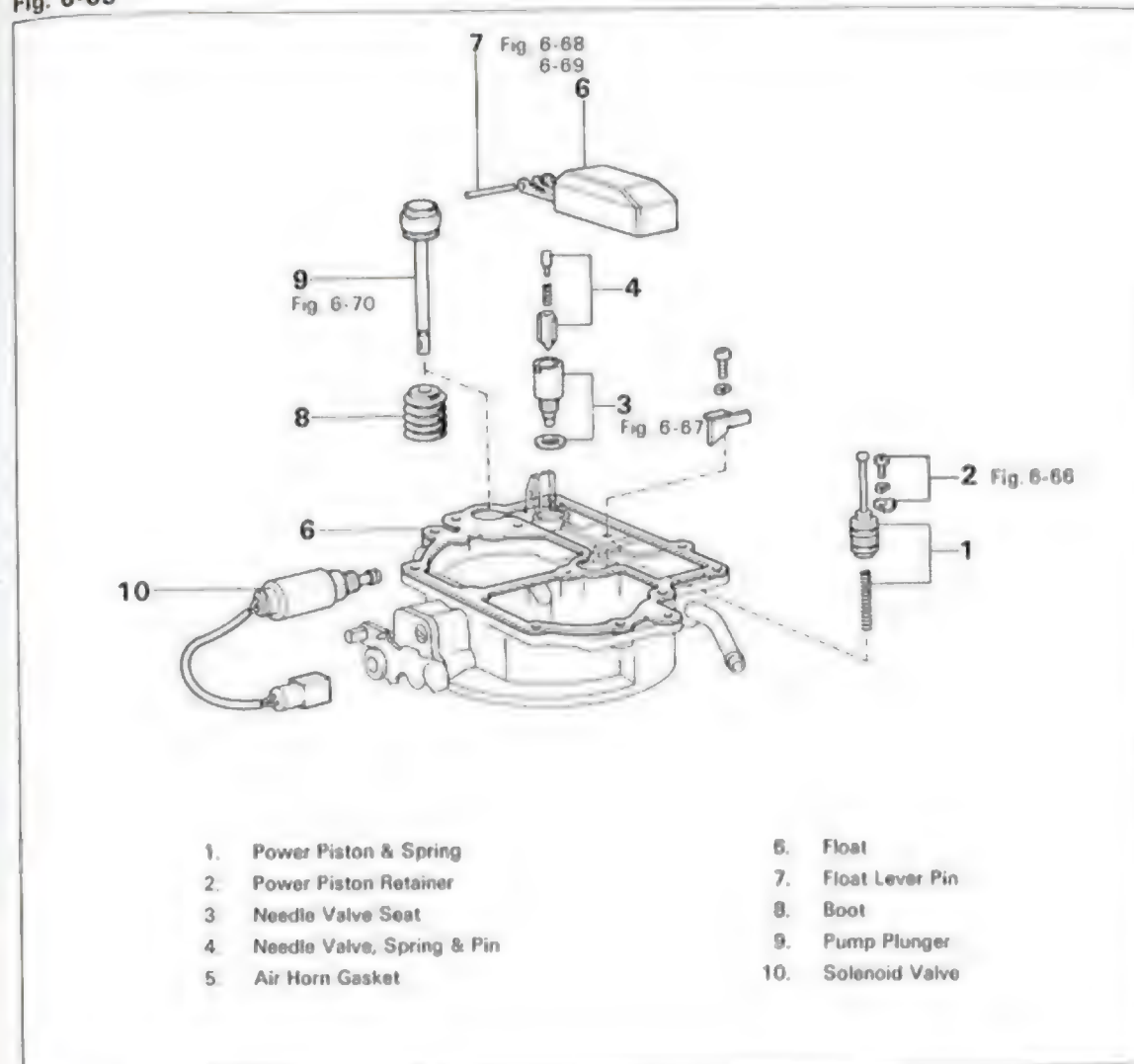


Check the choke valve action.

Float

Assemble the parts in the numerical order shown in the figure.

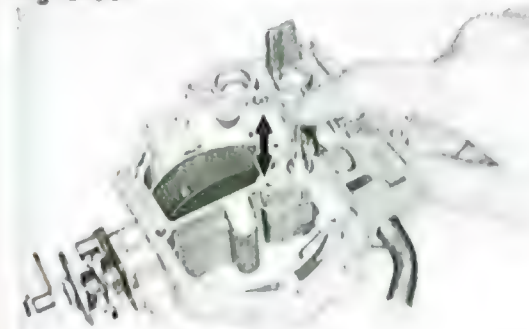
Fig. 6-65



1. Power Piston & Spring
2. Power Piston Retainer
3. Needle Valve Seat
4. Needle Valve, Spring & Pin
5. Air Horn Gasket

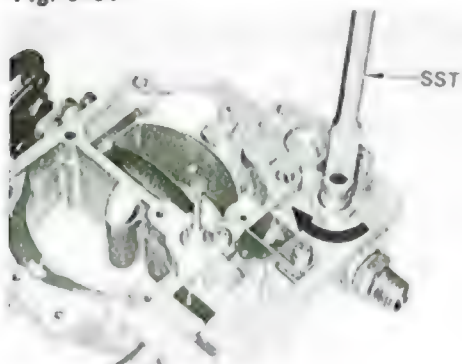
6. Float
7. Float Lever Pin
8. Boot
9. Pump Plunger
10. Solenoid Valve

Fig. 6-66



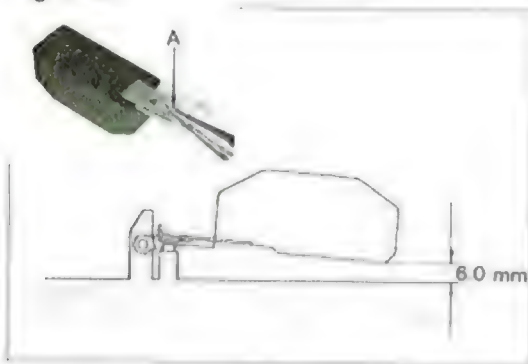
Make sure that the power piston moves smoothly

Fig. 6-67



Install the needle valve seat with SST.
SST [09860-11011]

Fig. 6-68



Adjust The Float Level

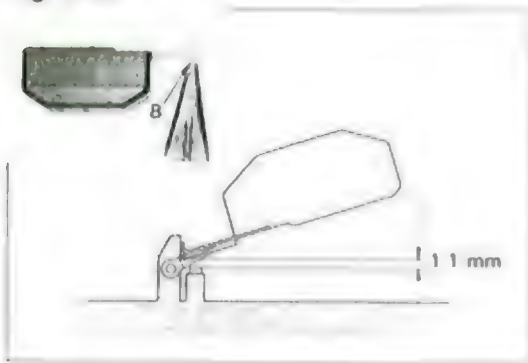
Allow the float to hang down by its own weight. Then check the clearance between the float tip and air horn with SST.
Adjust by bending part A of the float lip.
SST [09240-00014]

Float upper level: 6.0 mm
(0.236 in.)

— Note —

This measurement should be made without a gasket on the air horn.

Fig. 6-69

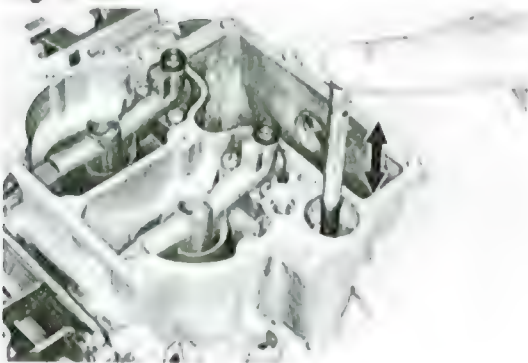


Adjust The Lowered Position

Lift up the float and check the clearance between the needle valve plunger and float lip with SST.
Adjust by bending part B of the float lip.
SST [09240-00020]

Float lower level: 1.1 mm
(0.043 in.)

Fig. 6-70

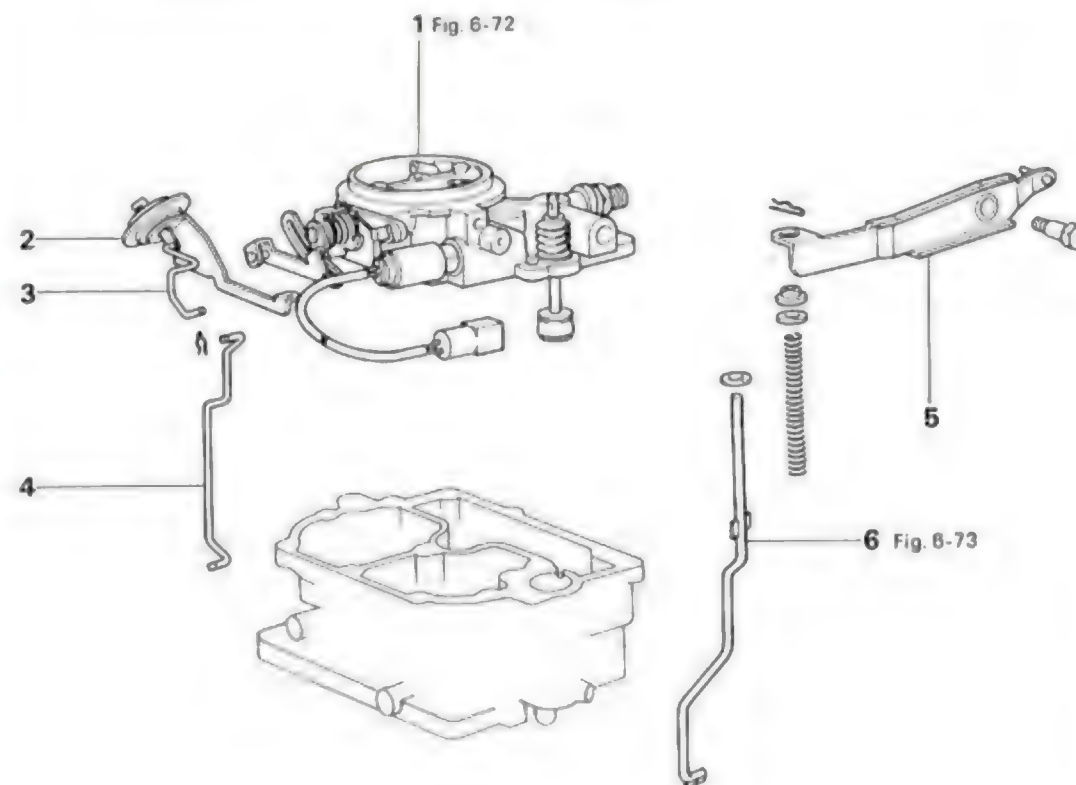


Insure that the pump plunger moves smoothly.

Air Horn

Assemble the parts in the numerical order shown in the figure.

Fig. 6-71



1. Air Horn with Gasket
2. Choke Breaker
3. Choke Breaker Connecting Link
4. Fast Idle Connecting Link
5. Pump Arm
6. Pump Connecting Link

Fig. 6-72



Before installing the air horn, make sure that the pump discharge weight is properly assembled

Fig. 6-73

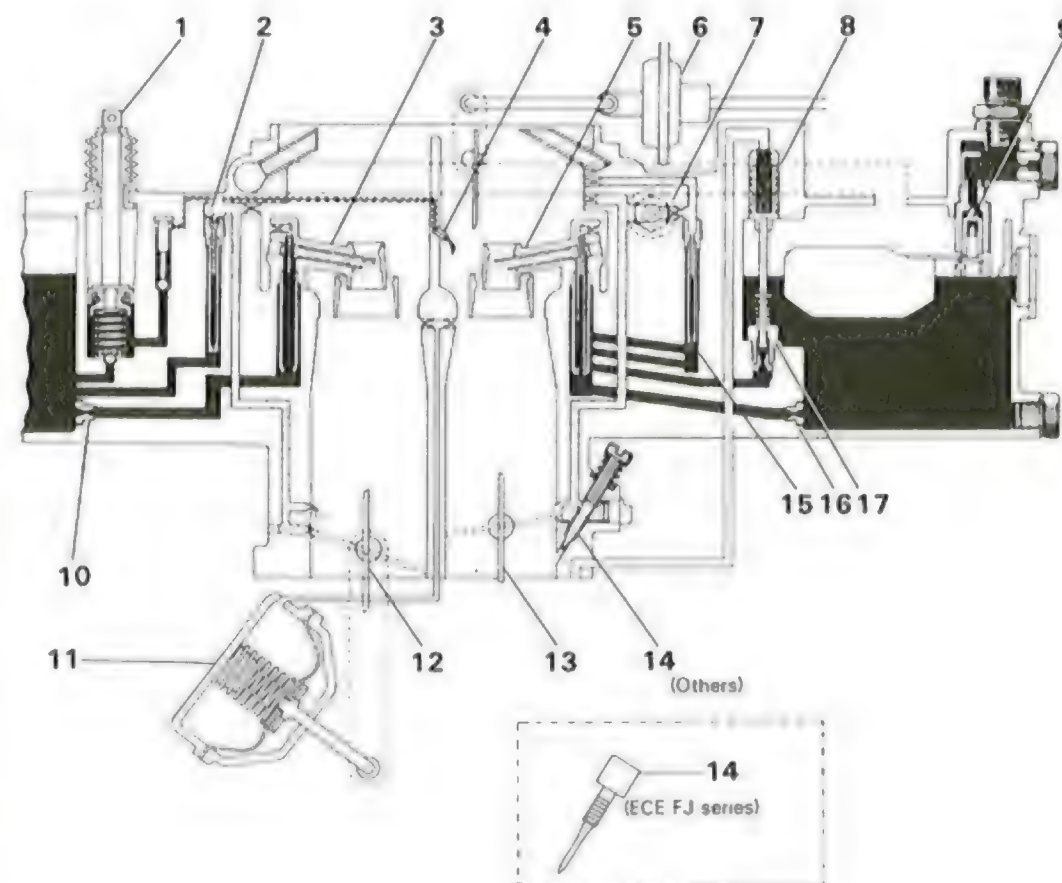


After assembly, make sure that each link moves smoothly.

CARBURETOR (General Countries)

CARBURETOR CIRCUIT

Fig. 6-74

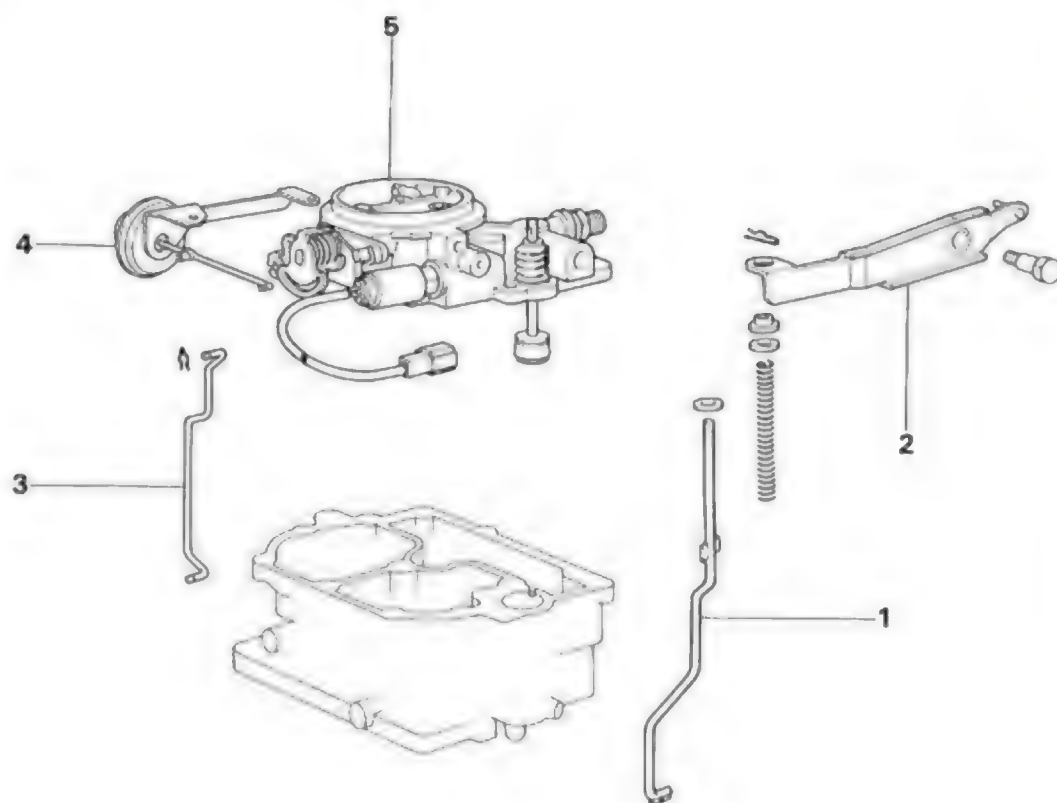


- | | |
|---|----------------------------------|
| 1. Pump Plunger | 9. Needle Valve |
| 2. 2nd Slow Jet | 10. 2nd Main Jet |
| 3. 2nd Main Nozzle | 11. Diaphragm |
| 4. Pump Jet | 12. 2nd Throttle Valve |
| 5. 1st Main Nozzle | 13. 1st Throttle Valve |
| 6. Choke Breaker (Throttle Positioner Diaphragm)
(Australia & ECE FJ series) | 14. Idle Mixture Adjusting Screw |
| 7. Solenoid Valve | 15. 1st Slow Jet |
| 8. Power Piston | 16. 1st Main Jet |
| | 17. Power Valve |

DISASSEMBLY**Air Horn**

Disassemble the parts in the numerical order shown in the figure.

Fig. 6-75

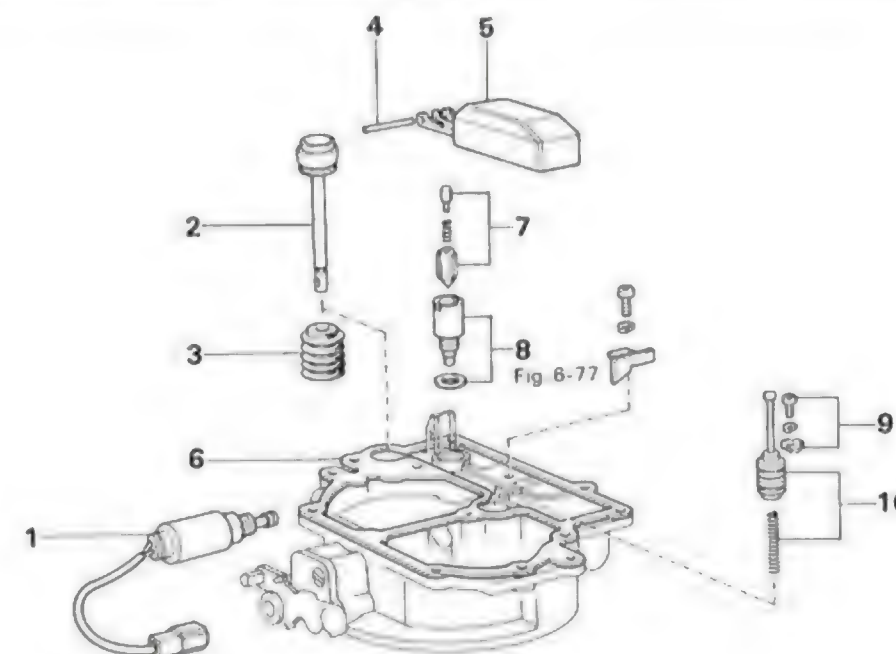


1. Pump Connecting Link
2. Pump Arm
3. Fast Idle Connecting Link
4. Choke Breaker (Throttle Positioner Diaphragm)
(Australia & ECE FJ series)
5. Air Horn with Gasket

Float

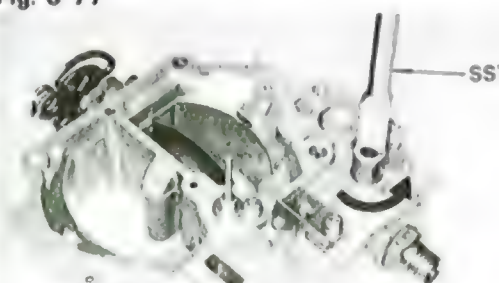
Disassemble the parts in the numerical order shown in the figure.

Fig. 6-76



- | | |
|--------------------|-------------------------------|
| 1. Solenoid Valve | 6. Air Horn Gasket |
| 2. Pump Plunger | 7. Needle Valve, Spring & Pin |
| 3. Boot | 8. Needle Valve Seat |
| 4. Float Lever Pin | 9. Power Piston Retainer |
| 5. Float | 10. Power Piston & Spring |

Fig. 6-77



Remove the needle valve seat with SST.
SST [09860-11011]

Choke System

Disassemble the parts in the numerical order shown in the figure.

Fig. 6-78

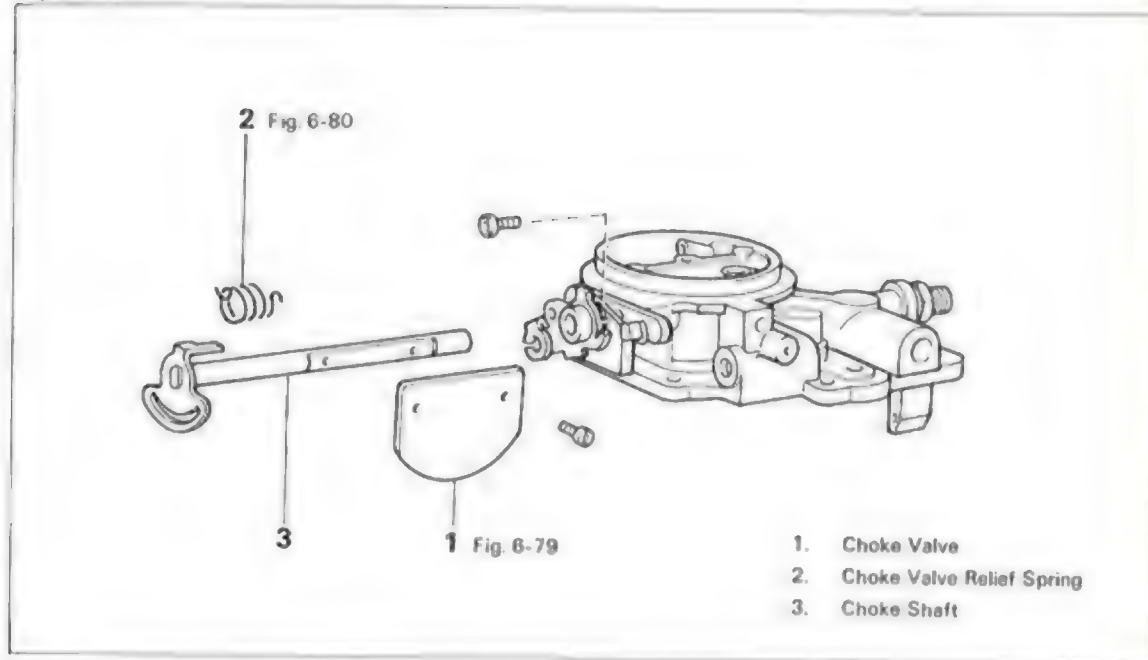


Fig. 6-79

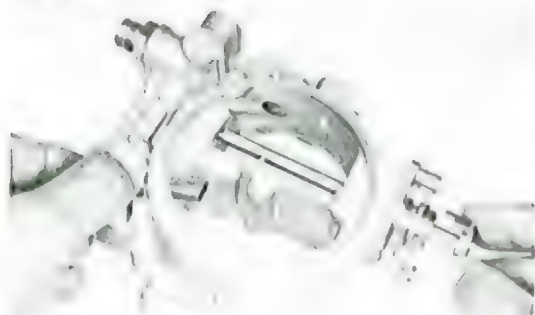


To remove the choke valve, file off the ends of the set screws.

— Note —

Do this only if it is necessary to replace the choke shaft.

Fig. 6-80

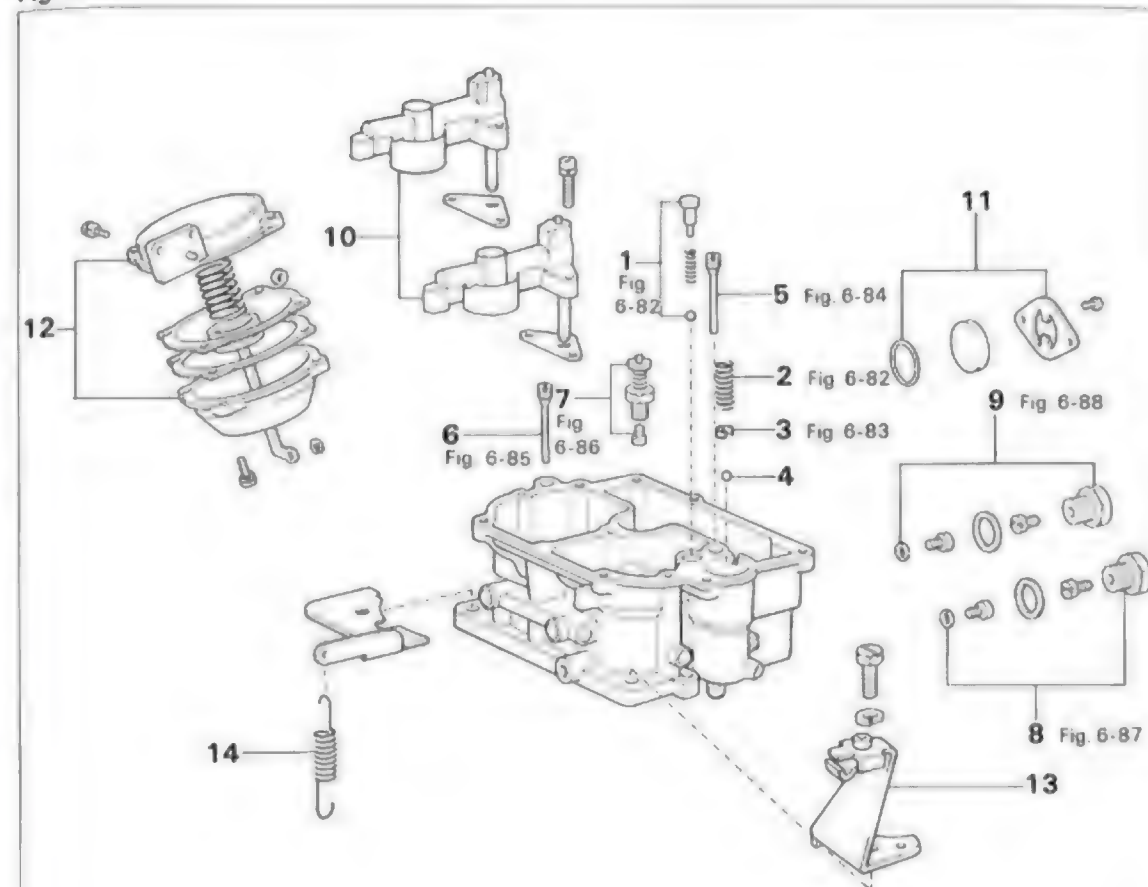


Unhook the choke valve relief spring and pull out the choke shaft.

Body

Disassemble the parts in the numerical order shown in the figure.

Fig. 6-81



1. Steel Ball for Discharge Weight & Spring
2. Pump Damping Spring
3. Check Ball Retainer
4. Steel Ball for Pump Plunger
5. 1st Slow Jet
6. 2nd Slow Jet
7. Power Valve

8. 1st Main Jet
9. 2nd Main Jet
10. Small Venturi
11. Level Gage Glass
12. Diaphragm
13. Choke Wire Clamp
14. Back Spring for Throttle Shaft

Fig. 6-82

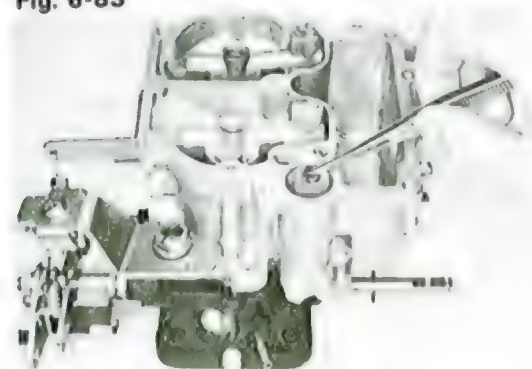


Drop out the steel ball for the discharge weight and springs.

— Note —

Be careful not to lose the steel ball.

Fig. 6-83



Remove the check ball retainer with a pair of tweezers and then remove the steel ball for the pump plunger.

— Note —

Be careful not to lose the steel ball.

Fig. 6-84



Remove the 1st slow jet with SST
SST [09860-11011]

Fig. 6-85



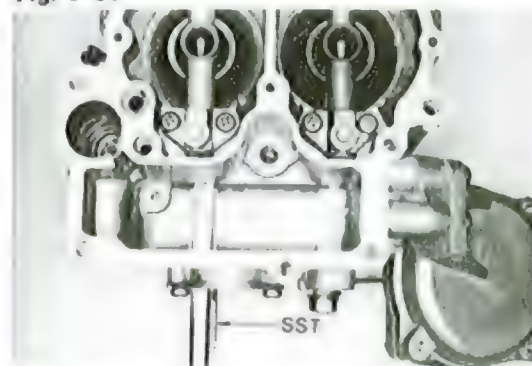
Remove the 2nd slow jet with SST,
SST [09860-11011]

Fig. 6-86



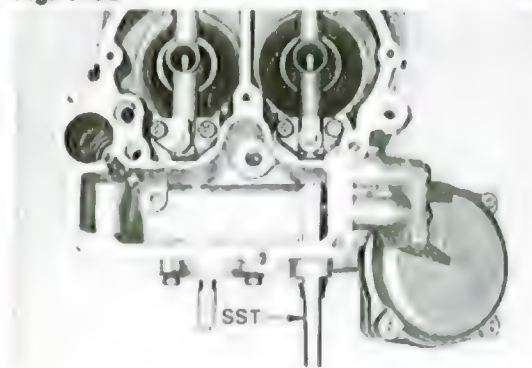
Remove the power valve with SST.
SST [09860-11011]

Fig. 6-87



Remove the 1st main jet with SST.
SST [09860-11011]

Fig. 6-88



Remove the 2nd main jet with SST
SST [09860-11011]

Flange

Disassemble the parts in the numerical order shown in the figure.

Fig. 6-89

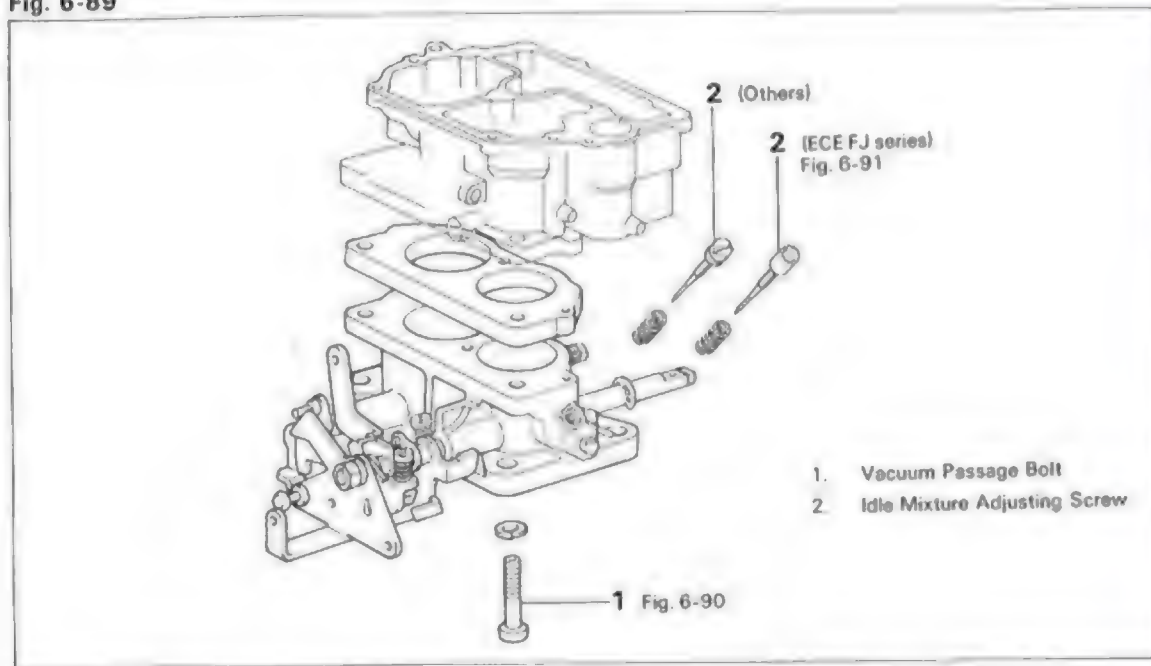
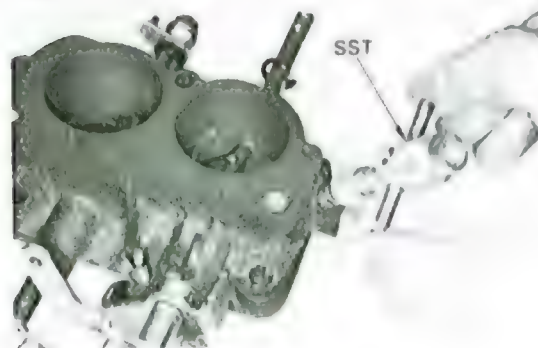


Fig. 6-90



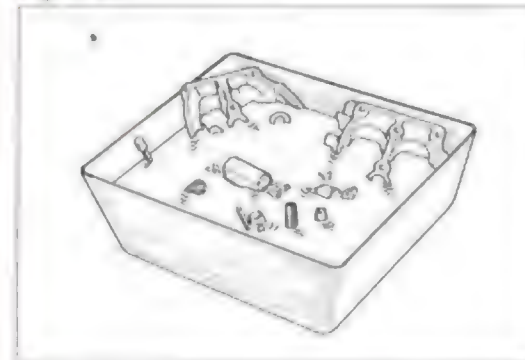
Remove the vacuum passage bolt with SST
SST [09860-11011]

Fig. 6-91



Remove the idle mixture adjusting screw with
SST (ECE) or a screwdriver (others)
SST [09243-00020]

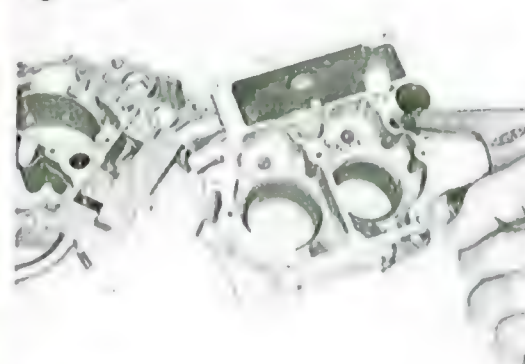
Fig. 6-92

**INSPECTION**

— Precaution —

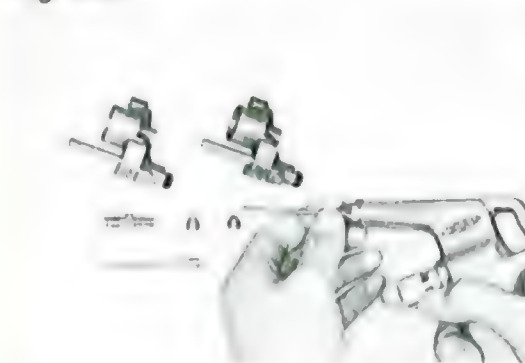
1. Before inspection, wash all parts thoroughly with gasoline.

Fig. 6-93



2. Using compressed air, blow all dirt and other foreign matter from the jets and similar parts, and from the fuel passages and apertures in the body.

Fig. 6-94



3. Never clean the jets or orifices with wire or a drill. This could enlarge the openings and result in excessive fuel consumption.

Fig. 6-95



Inspect the following parts and replace any part damaged.

Air Horn Parts

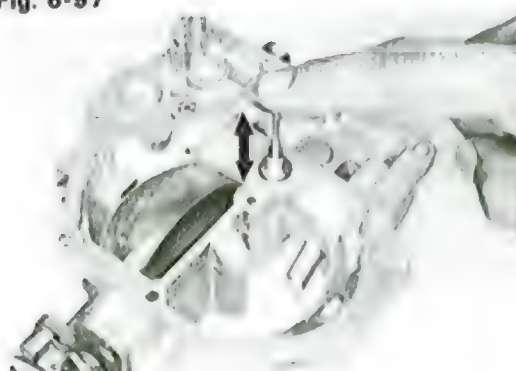
1. Air horn: Check for cracks, damaged threads and wear on choke shaft bores

Fig. 6-96



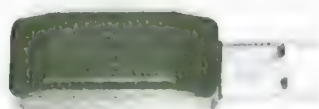
2. Power piston: Check for damage.
Spring: Check for deformation or rust.
Power piston bore: Check for wear or damage.

Fig. 6-97



3. Make sure that the power piston moves smoothly in the air horn bore.

Fig. 6-98



4. Float and float lever pin: Check for wear or breaks.

Fig. 6-99



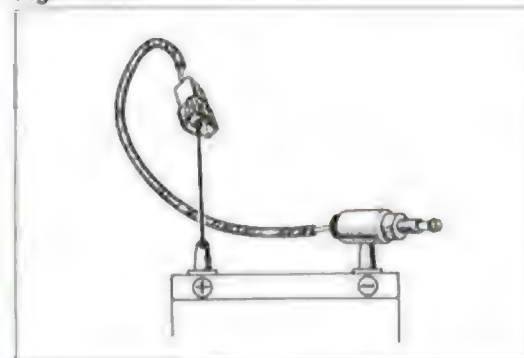
5. Strainer: Check for rust or breaks
6. Needle valve surface
7. Needle valve seat.

Fig. 6-100



8. Choke valve: Check for deformation.
Choke shaft: Check for wear, bending or improper fit in housing.

Fig. 6-101



9. Solenoid valve: Connect the wiring to the battery positive terminal and ground the body. Make sure that the needle valve is pulled in.

Fig. 6-102



10. Choke breaker (Throttle positioner diaphragm) (Australia & ECE FJ series): Apply vacuum to the diaphragm. Check that vacuum does not drop immediately and the link moves when vacuum is applied.

— Note —

The throttle positioner diaphragm is used in common with the choke breaker system.

Fig. 6-103



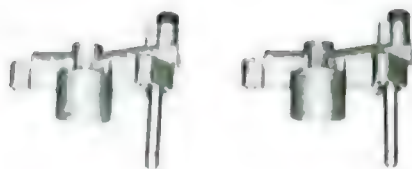
11. Pump plunger: Check for wear on sliding surface and for damaged or deformed leather.
Boot: Check for damage.

Fig. 6-104

**Body Parts**

- 1 Body Check for cracks, scored mounting surfaces and damaged threads.

Fig. 6-105



2. Small venturis: Check for damage or clogging.

Fig. 6-106



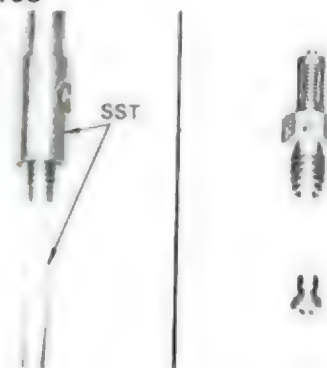
3. Jets: Check for damage or clogging. Check for damaged contact surface, threads and screwdriver slots.

Fig. 6-107



- 4 Power valve Check for faulty opening and closing action. Check for damaged contact surfaces and threads.

Fig. 6-108



5. Remove the jet with SST. SST [09860-11011]

Fig. 6-109



6. Pump damping spring: Check for deformation or rust. Steel ball: Check for damage or rust.

Fig. 6-110



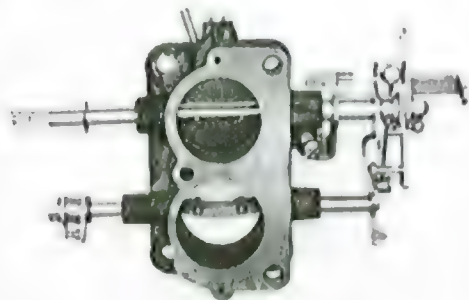
7. Diaphragm: Check the diaphragm, housing and spring for wear or damage.

Fig. 6-111



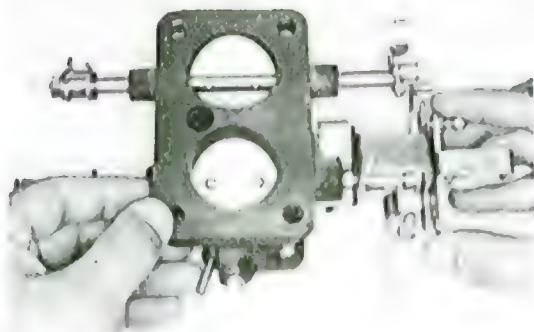
- 8 Assemble the diaphragm as shown in the figure

Fig. 6-112

**Flange Parts**

1. Flange: Check for cracks, damaged mounting surfaces, threads and for wear on throttle shaft bearings.

Fig. 6-113



2. Throttle valves: Check for worn or deformed valves and for wear, bending, twisting or faulty movement inside the housing shaft.

Fig. 6-114

ECE FJ Series



Others



3. Idle mixture adjusting screw: Check for damaged tapered tip or threads

ASSEMBLY**Flange**

Assemble the parts in the numerical order shown in the figure.

Fig. 6-115

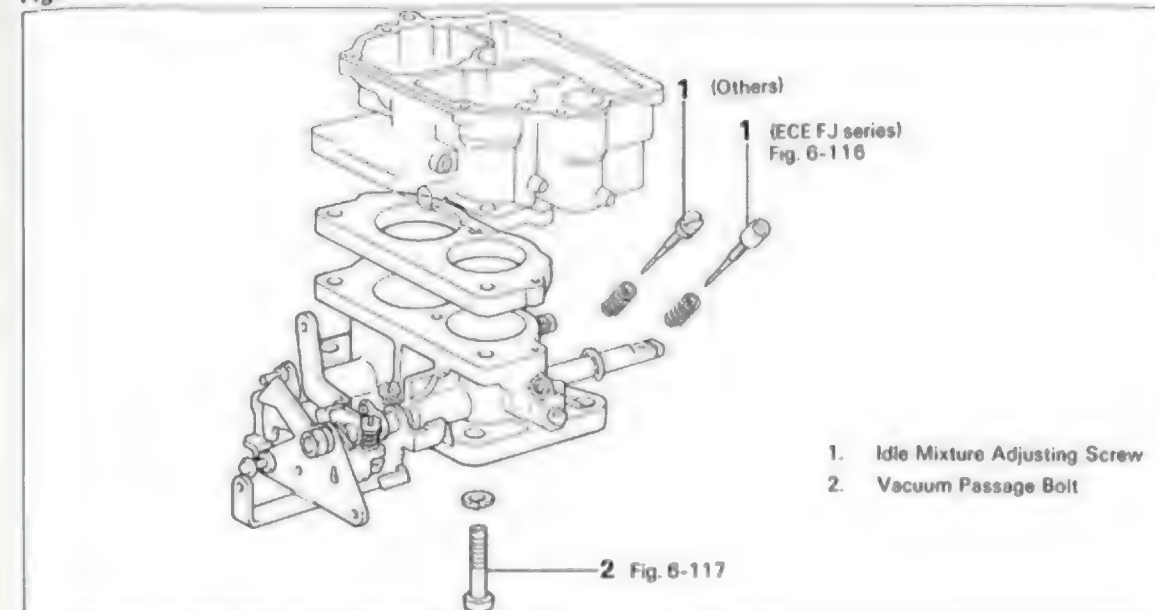
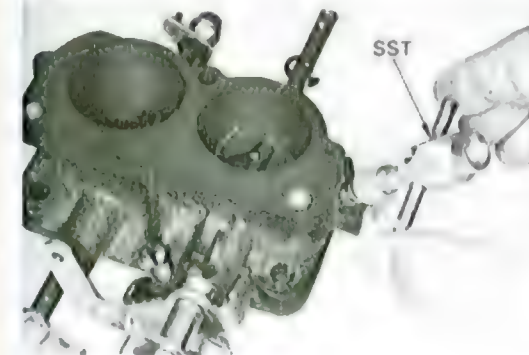


Fig. 6-116



- Install the idle mixture adjusting screw temporarily with SST (ECE) or a screwdriver (others)
SST [09243-00020]

Fig. 6-117



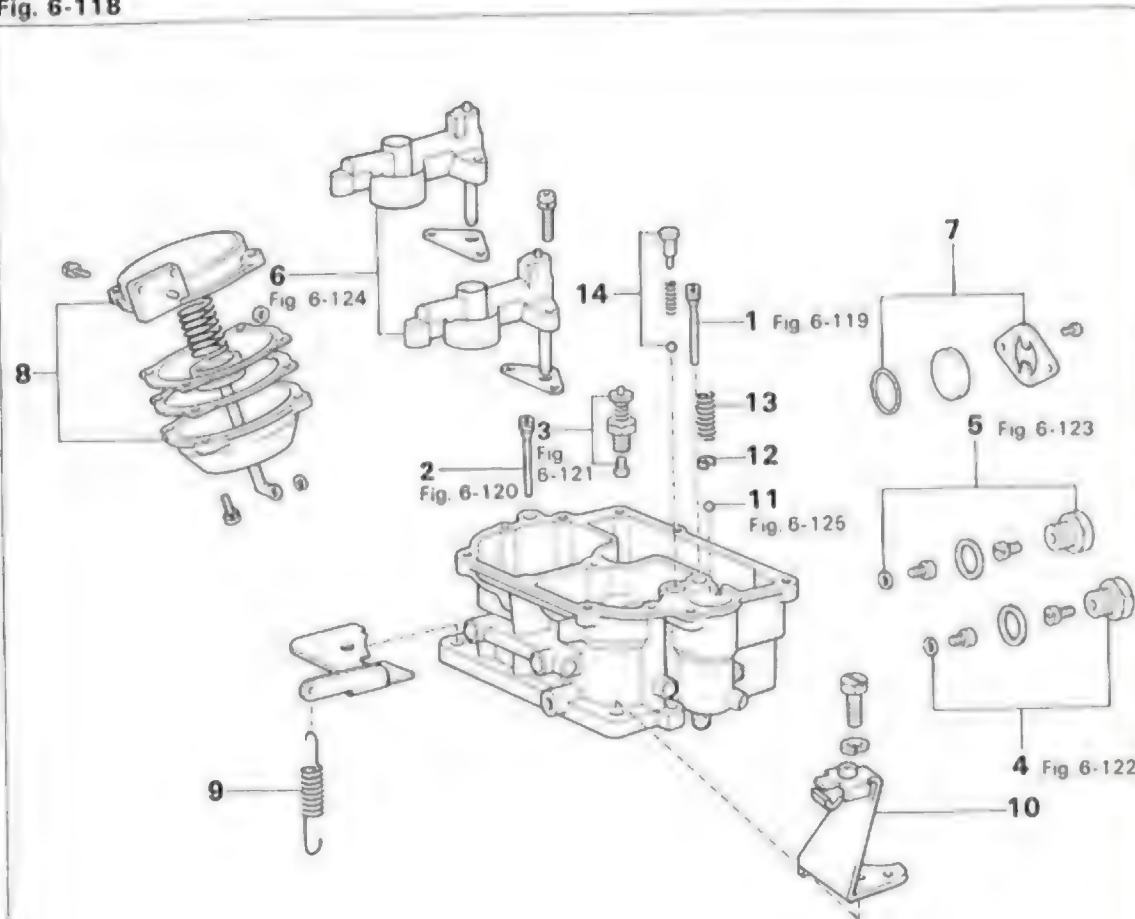
- Tighten the vacuum passage bolt with SST.
SST [09860-11011]

— Note —
Use a new gasket.

Body

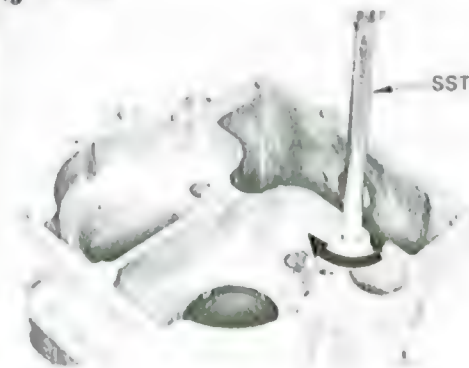
Assemble the parts in the numerical order shown in the figure.

Fig. 6-118



- | | |
|---------------------|--|
| 1. 1st Slow Jet | 8. Diaphragm |
| 2. 2nd Slow Jet | 9. Back Spring for Throttle Shaft |
| 3. Power Valve | 10. Choke Wire Clamp |
| 4. 1st Main Jet | 11. Steel Ball for Pump Plunger |
| 5. 2nd Main Jet | 12. Check Ball Retainer |
| 6. Venturi | 13. Pump Damping Spring |
| 7. Level Gage Glass | 14. Steel Ball for Discharge Weight & Spring |

Fig. 6-119



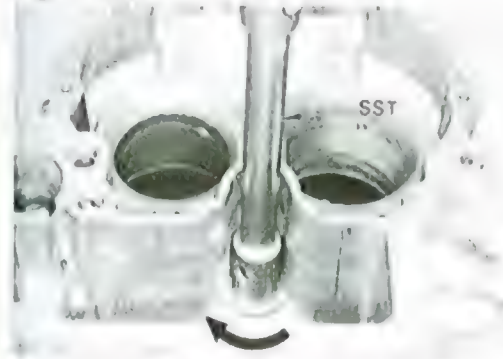
Install the 1st slow jet with SST.
SST [09860-11011]

Fig. 6-120



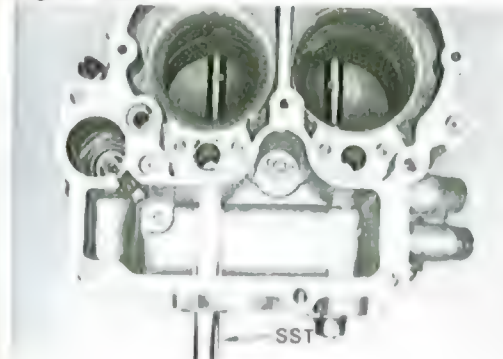
Install the 2nd slow jet with SST.
SST [09860-11011]

Fig. 6-121



Install the power valve with SST.
SST [09860-11011]

Fig. 6-122



Install the 1st main jet with SST.
SST [09860-11011]

— Note —

The 1st main jet is brass colored.

Fig. 6-123

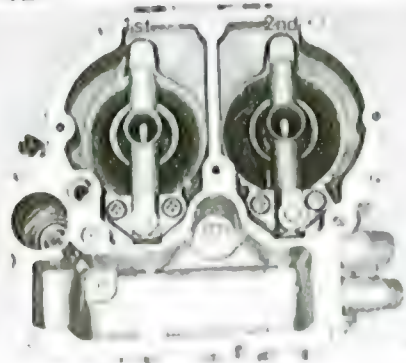


Install the 2nd main jet with SST.
SST [09860-11011]

— Note —

The 2nd main jet is chrome colored.

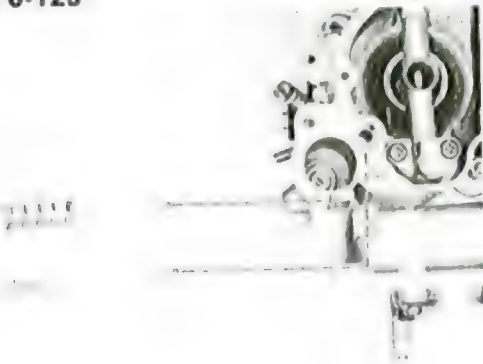
Fig. 6-124



Install the venturis.

1st small venturi — Chrome colored
2nd small venturi — Brass colored

Fig. 6-125



Install the steel balls, being careful not to mix
up the two sizes of balls.

Smaller ball — For pump plunger
Larger ball — For discharge weight

Choke System

Assemble the parts in the numerical order
shown in the figure.

Fig. 6-126

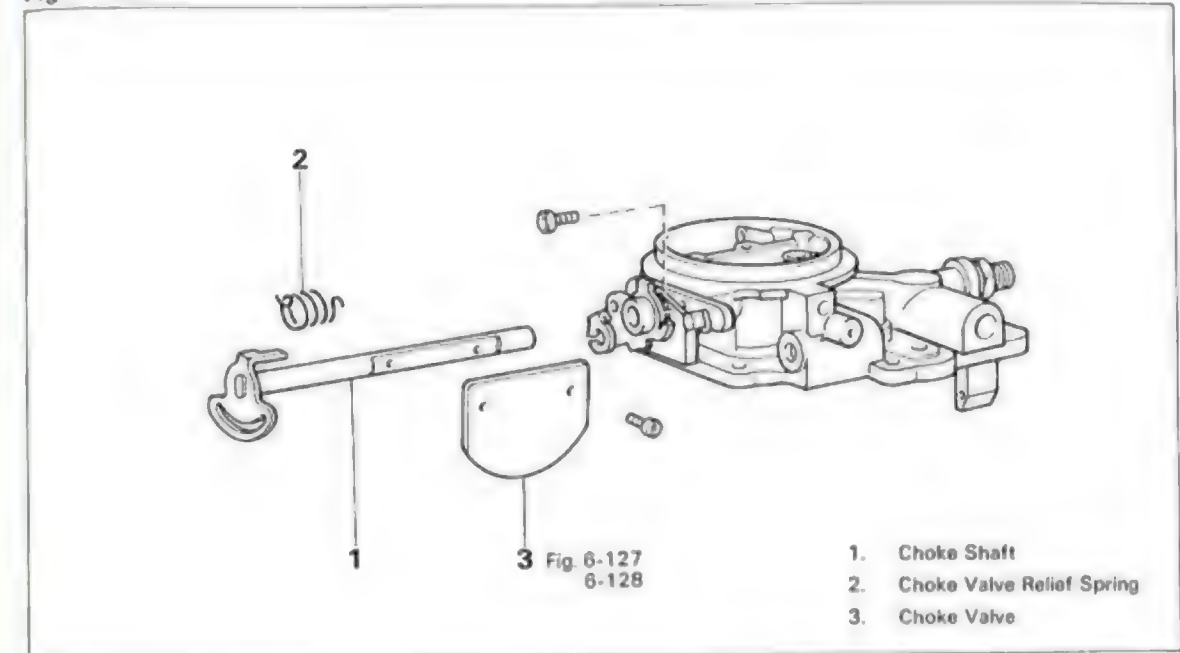
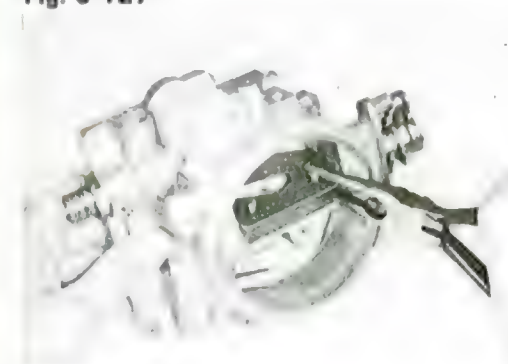


Fig. 6-127

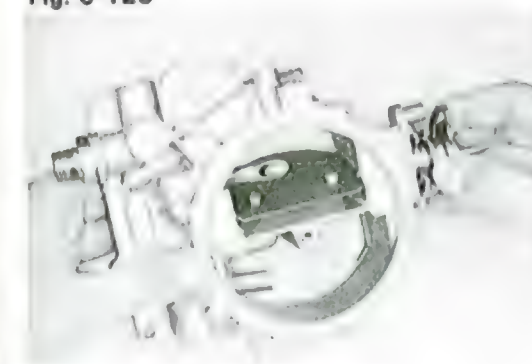


Install the choke valve

— Note —

Stake the choke shaft screws after assembling.

Fig. 6-128



Check the choke valve action.

Float

Assemble the parts in the numerical order shown in the figure

Fig. 6-129

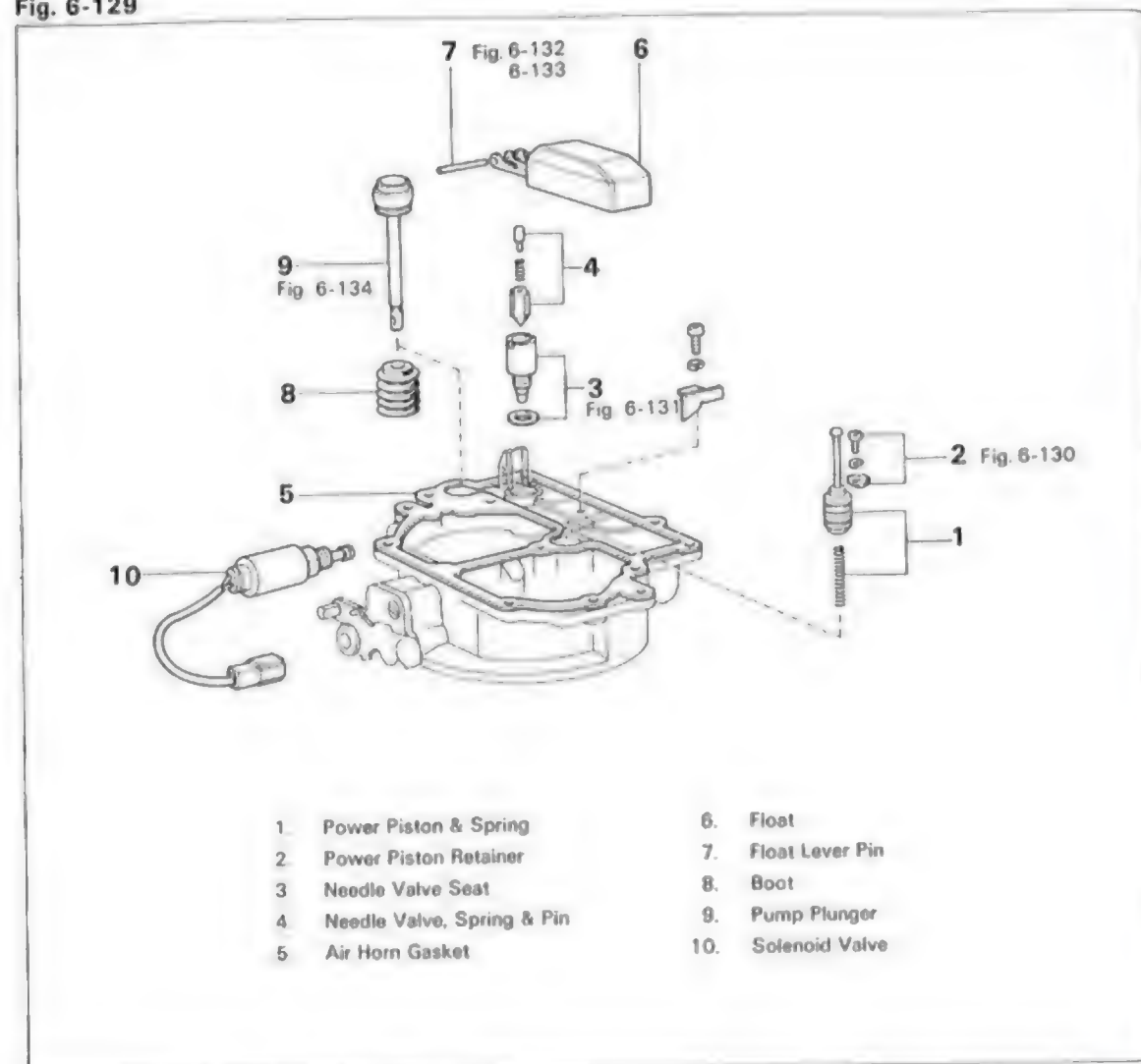
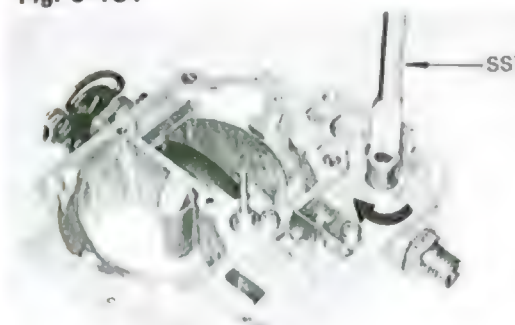


Fig. 6-130



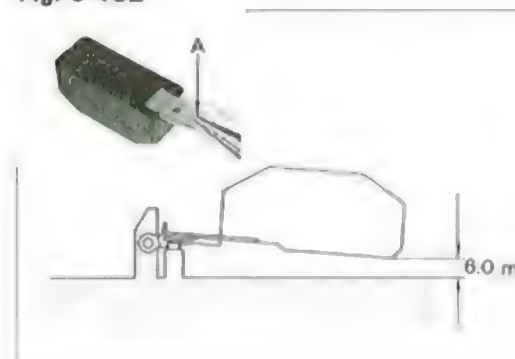
Make sure that the power piston moves smoothly.

Fig. 6-131



Install the needle valve seat with SST.
SST [09860-11011]

Fig. 6-132

**Adjust The Float Level**

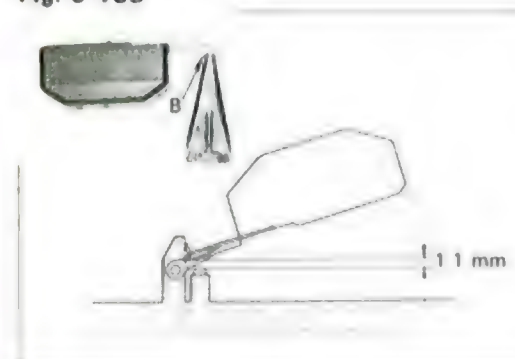
Allow the float to hang down by its own weight. Then check the clearance between the float tip and air horn with SST. Adjust by bending part A of the float lip.

SST [09240-00014]
Float upper level: 6.0 mm (0.236 in.)

— Note —

This measurement should be made without a gasket on the air horn.

Fig. 6-133

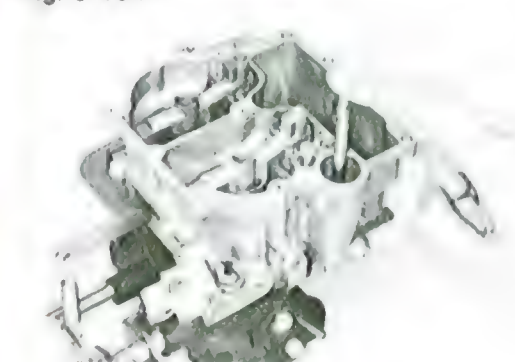
**Adjust The Lowered Position**

Lift up the float and check the clearance between the needle valve plunger and float lip with SST.

Adjust by bending part B of the float lip.
SST [09240-00020]

Float lower level: 1.1 mm (0.043 in.)

Fig. 6-134

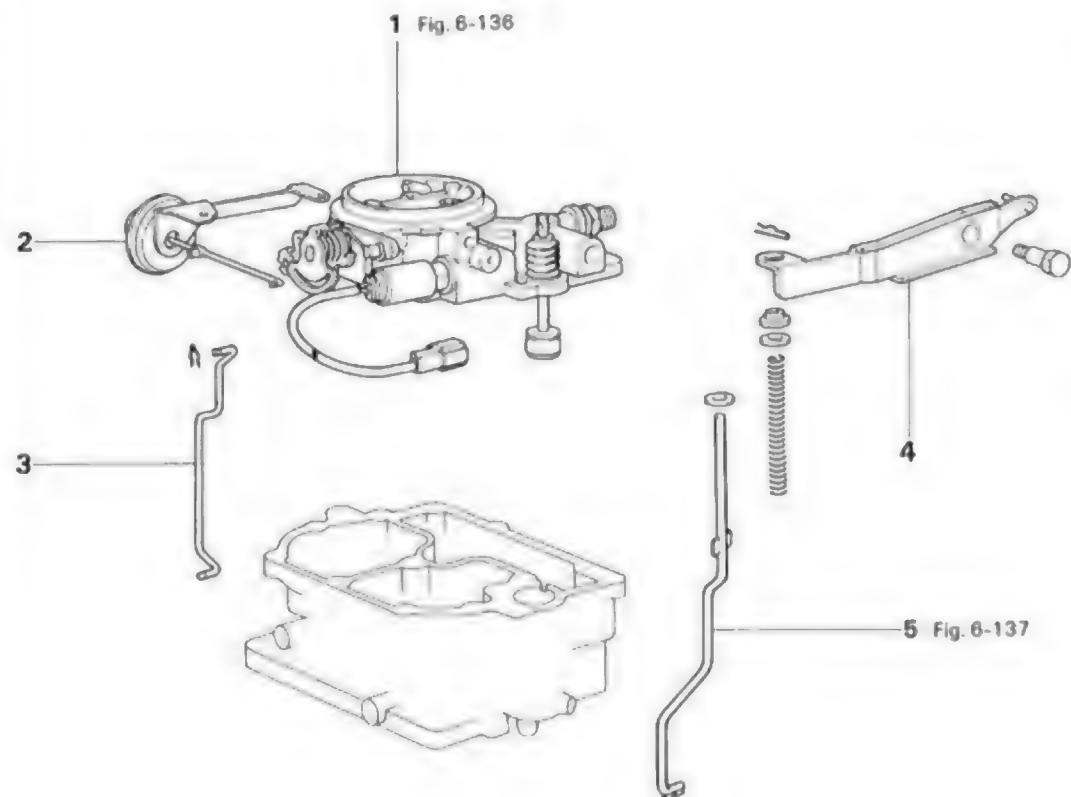


Insure that the pump plunger moves smoothly.

Air Horn

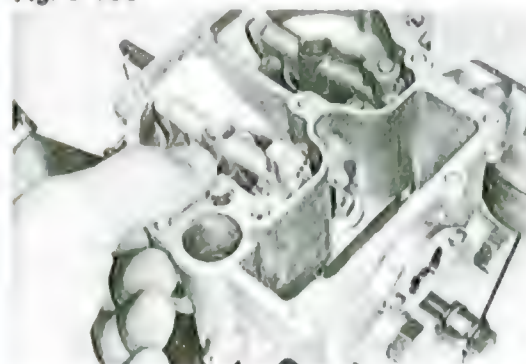
Assemble the parts in the numerical order shown in the figure.

Fig. 6-135



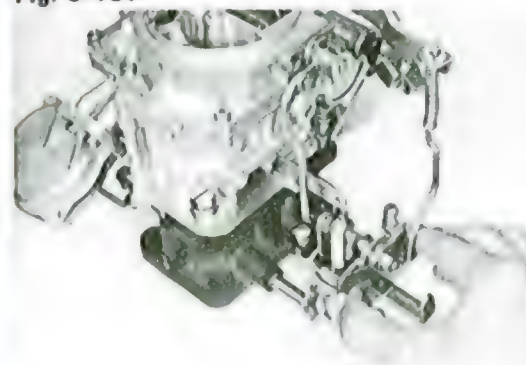
- 1 Air Horn with Gasket
- 2 Choke Breaker (Throttle Positioner Diaphragm)
(Australia & ECE FJ series)
- 3 Fast Idle Connecting Link
- 4 Pump Arm
- 5 Pump Connecting Link

Fig. 6-136



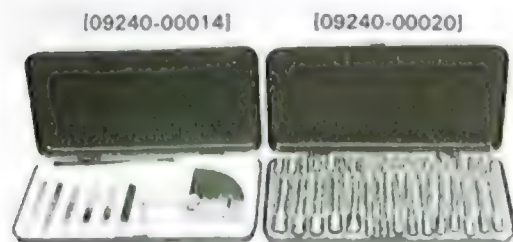
Before installing the air horn, make sure that the pump discharge weight is properly assembled.

Fig. 6-137



After assembly, make sure that each link moves smoothly.

Fig. 6-138



CARBURETOR ADJUSTMENT

Make adjustment with SST.
SST [09240-00014]
[09240-00020]

Fig. 6-139



PRIMARY THROTTLE VALVE OPENING

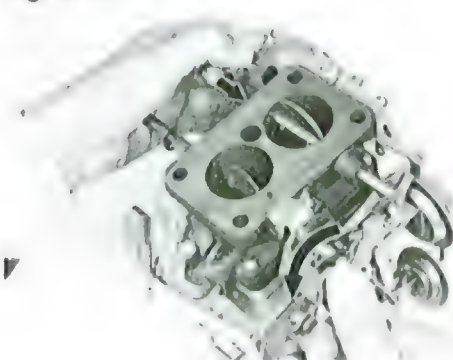
- 1 Fully open the primary throttle valve and check the opening angle.
Opening angle from horizontal plane: 90°

Fig. 6-140



- 2 Adjust by bending the throttle lever stopper indicated in the figure.

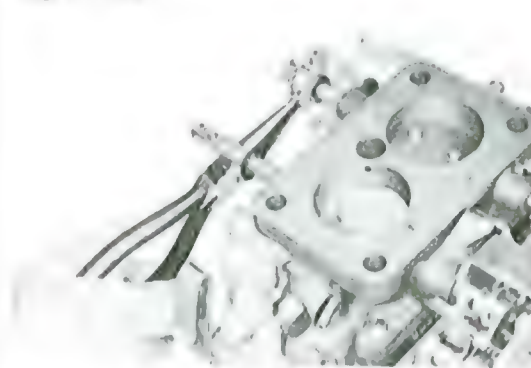
Fig. 6-141



SECONDARY THROTTLE VALVE OPENING

- 1 Fully open the secondary throttle valve and check the opening angle.
Opening angle from horizontal plane: 90°

Fig. 6-142



- 2 Adjust by bending the throttle lever stopper indicated in the figure.

Fig. 6-143



KICK-UP

- 1 Fully open the primary throttle valve and, using SST, check the secondary throttle valve opening angle.
SST [09240-00014]
Kick-up angle: 25°

Fig. 6-144



- 2 Adjust by bending the secondary throttle lever indicated in the figure.

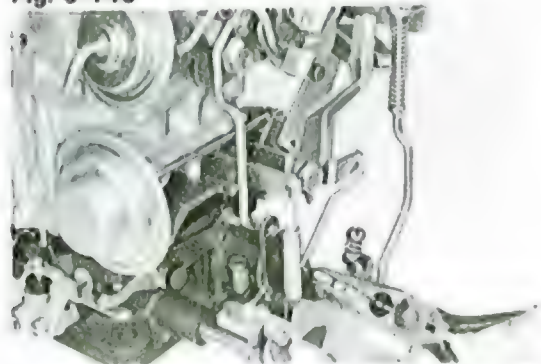
Fig. 6-145



SECONDARY TOUCH ANGLE

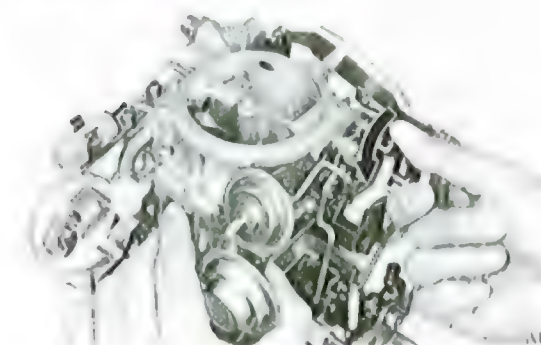
- 1 Check the primary throttle valve opening with SST at the same time the secondary throttle valve just starts to open.
SST [09240-00014]
Secondary touch angle from horizontal plane: 67°

Fig. 6-146



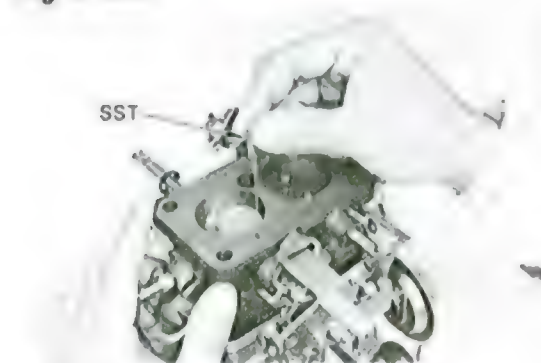
2. Adjust by bending the touch lever indicated in the figure.

Fig. 6-147

**FAST IDLE CLEARANCE**

1. Fully close the choke valve by turning the choke shaft lever.

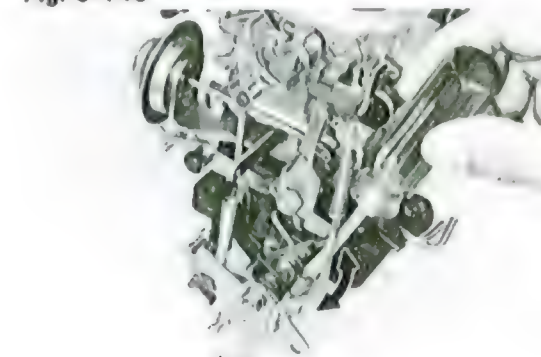
Fig. 6-148



2. Check the clearance between the primary throttle valve and carburetor flange with SST [09240-00020]

Fast idle clearance: 1.3 mm
(0.051 in.)

Fig. 6-149



3. Adjust by turning the fast idle adjusting screw indicated in the figure.

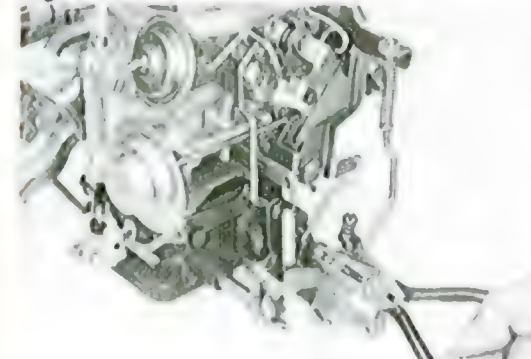
Fig. 6-150

**UNLOADER (USA)**

1. Fully open the primary throttle valve and check the choke valve angle with SST [09240-00014]

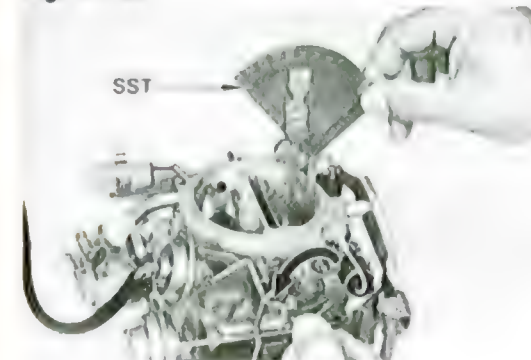
Choke valve angle from horizontal plane: 50°

Fig. 6-151



2. Adjust by bending the primary throttle arm indicated in the figure.

Fig. 6-152

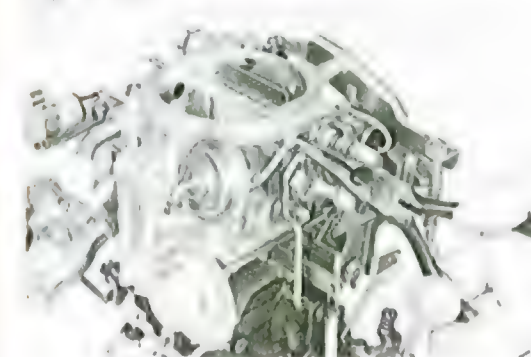
**CHOKE BREAKER (USA, Australia & ECE FJ series)**

1. Apply vacuum to the choke breaker diaphragm.
2. While closing the choke valve by hand, check the choke valve angle with SST [09240-00014]

Choke valve opening angle from horizontal plane:

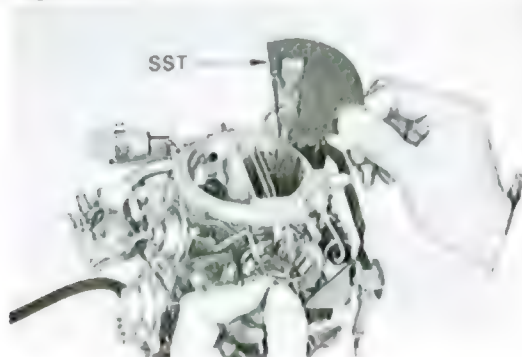
USA 45°
Others 38°

Fig. 6-153



3. Adjust by bending the choke breaker link indicated in the figure.

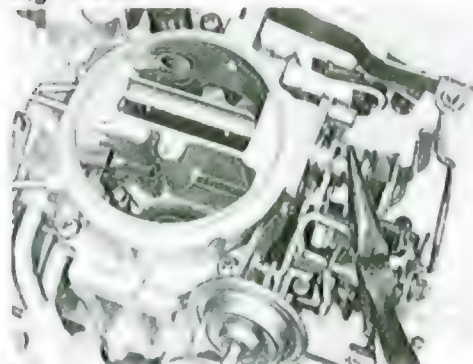
Fig. 6-154

**CHOKE OPENER (USA)**

1. Fully close the choke valve by turning the choke shaft lever.
2. Apply vacuum to the diaphragm and then check the choke valve angle with SST SST [09240-00014]

Choke valve opening angle from horizontal plane: 75°

Fig. 6-155



3. Adjust by bending the choke shaft stopper indicated in the figure.

Fig. 6-156

**THROTTLE POSITIONER (Australia & ECE FJ series)**

1. Apply vacuum to the throttle positioner diaphragm.
2. Check the throttle valve opening with SST. SST [09240-00014]

Throttle valve opening angle from horizontal plane:

N.S.W. 11°
Others 10°

Fig. 6-157

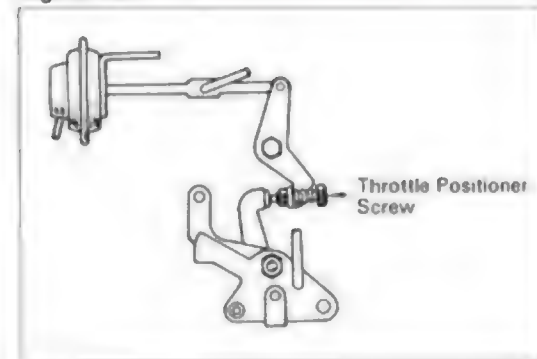
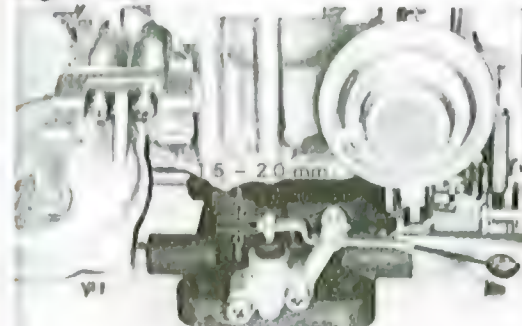


Fig. 6-158

**SLOW CUT VALVE (USA)**

1. Set the primary throttle valve opening to the secondary touch angle (67°).

Fig. 6-159

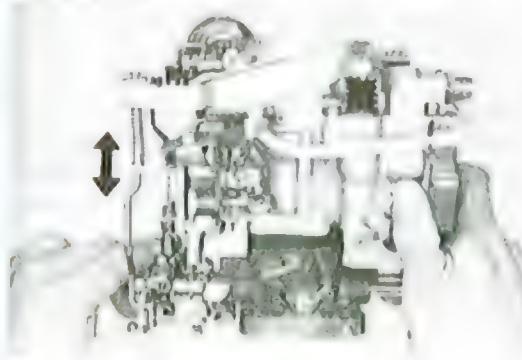


2. Check the slow cut valve stroke and adjust by bending the lever indicated in the figure.

Slow cut valve stroke:

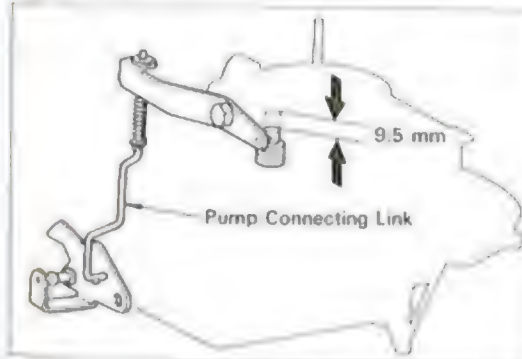
1.5 - 2.0 mm
(0.059 - 0.079 in.)

Fig. 6-160

**ACCELERATION PUMP**

1. While rotating the throttle shaft, check that the pump connecting link moves smoothly.

Fig. 6-161

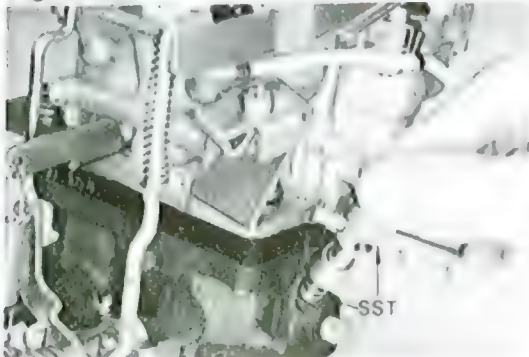


2. Check the acceleration pump stroke and adjust by bending the pump connecting link.

Acceleration pump stroke:

9.5 mm
(0.374 in.)

Fig. 6-162

**IDLE MIXTURE ADJUSTING SCREW**

(except USA)

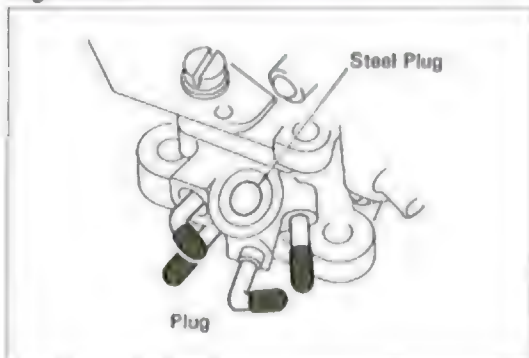
Tighten the idle mixture adjusting screw fully and then unscrew it the following amount with SST(ECE) or a screwdriver (others).
SST [09243-00020]

Return from fully closed:

ECE & N.S.W. 2-1/2 turns

Others 2 turns

Fig. 6-163



(USA)

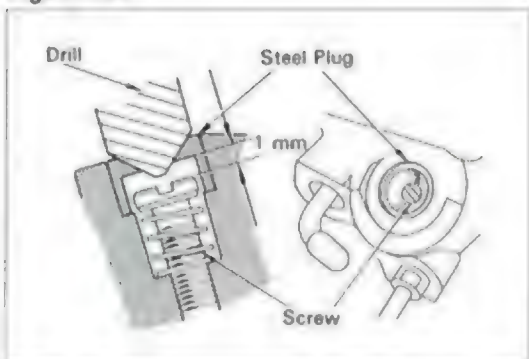
If necessary, remove the steel plug and idle mixture adjusting screw referring to the following procedure:

1. Mark the center of the plug with a punch.

— Note —

Plug each carburetor vacuum port to prevent entry of steel particles when drilling.

Fig. 6-164

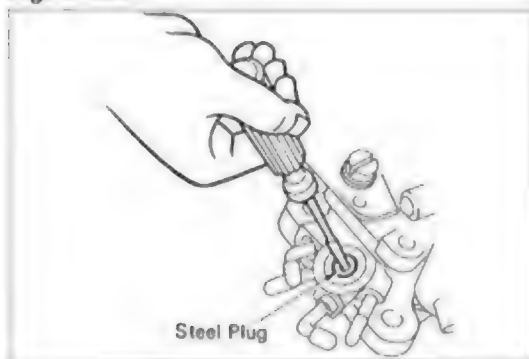


2. Drill a 8.5 mmφ (0.335 in.φ) hole in the center of the plug.

— Note —

As there is only 1 mm (0.04 in.) clearance between the plug and screw, drill carefully and slowly to avoid drilling onto the screw.

Fig. 6-165

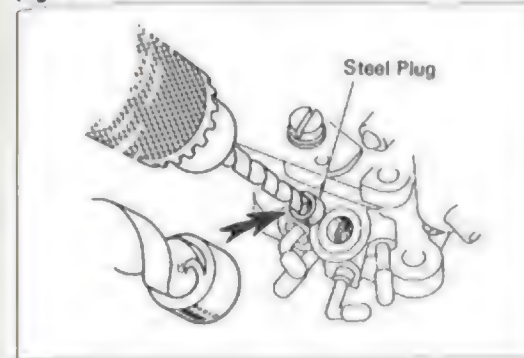


3. Through the hole in the plug, fully screw in the mixture adjusting screw with a screwdriver

— Note —

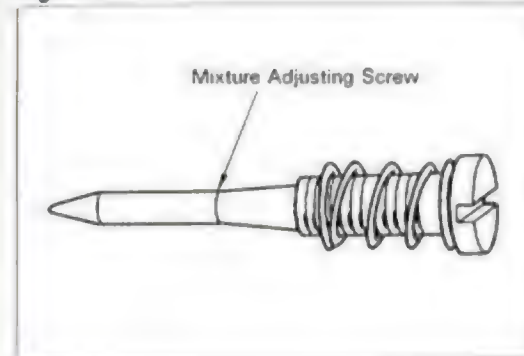
Be careful not to damage the screw tip by tightening the screw too tight.

Fig. 6-166



4. Use a 9.5 mmφ (0.374 in.φ) drill to force the plug off.

Fig. 6-167

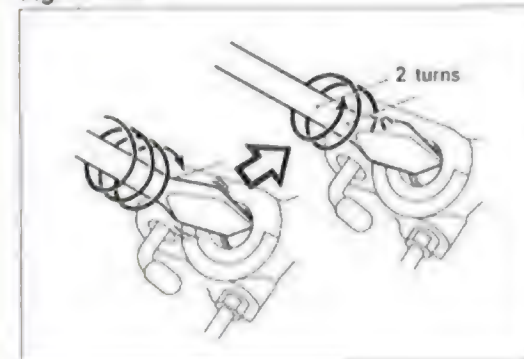


5. Blow off any steel particles with compressed air and remove the screw.

— Note —

If the drill has gnawed into the screw tip or if the tapered position is damaged, replace the screw.

Fig. 6-168



6. Fully screw in the idle mixture adjusting screw and then unscrew it about 2 turns.

— Note —

1. Be careful not to damage the screw tip by tightening the screw too tight.
2. Do not install the steel plug until the idle mixture adjustment is finished.

IDLE MIXTURE ADJUSTMENT (USA)

In the case of the steel plug being removed, check the idle mixture speed referring to the following procedures.

1. Check the following items before adjustment:

- (1) Air cleaner installed
- (2) Normal operating coolant temperature
- (3) Choke fully open
- (4) All accessories switched off
- (5) All vacuum lines connected
- (6) Ignition timing set correctly
- (7) Transmission in neutral
- (8) Fuel level should be about even with the correct level in the sight glass.

Fig. 6-169

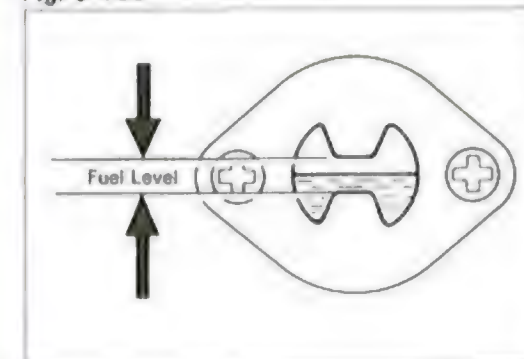
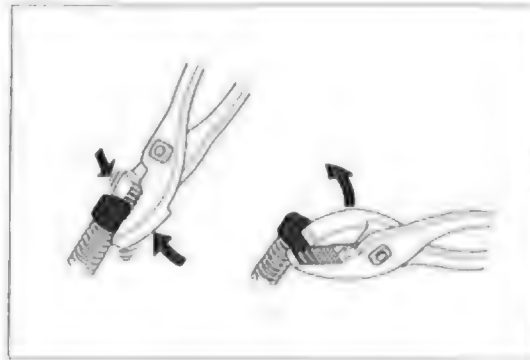
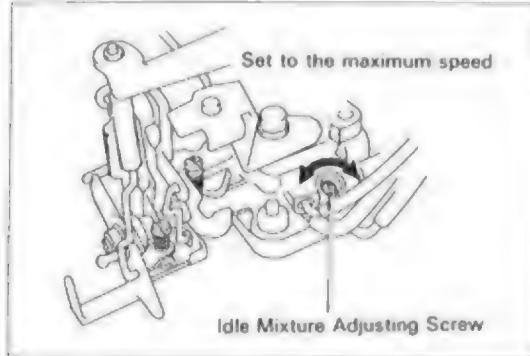


Fig. 6-170



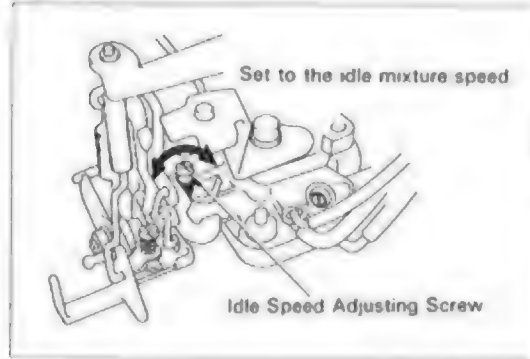
2. Break the idle limiter cap on the idle speed adjusting screw if installed.

Fig. 6-171



3. Start the engine and set to the maximum speed by turning the idle mixture adjusting screw.

Fig. 6-172

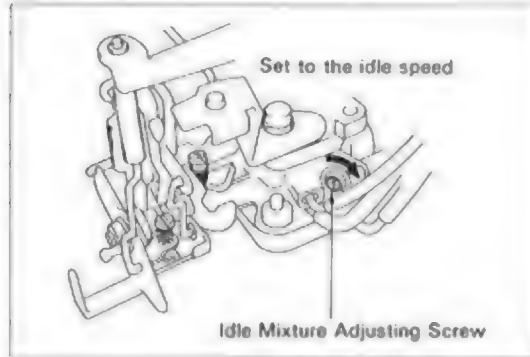


4. Set to the idle mixture speed by turning the idle speed adjusting screw.
Idle mixture speed: 690 rpm

— Note —

Before moving to the next step, continue adjustments 3 and 4 until the maximum speed will not rise any further no matter how much the IDLE MIXTURE ADJUSTING SCREW is adjusted.

Fig. 6-173

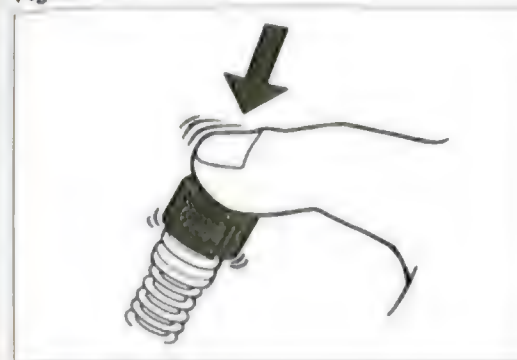


5. Set to the idle speed by screwing in the idle mixture adjusting screw.
Idle speed: 650 rpm

— Note —

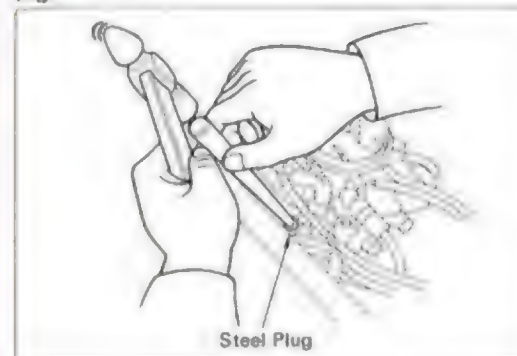
This is the LEAN DROP METHOD for setting the idle speed and mixture.

Fig. 6-174



6. Install a new limiter cap on the idle speed adjusting screw, if one was installed.

Fig. 6-175

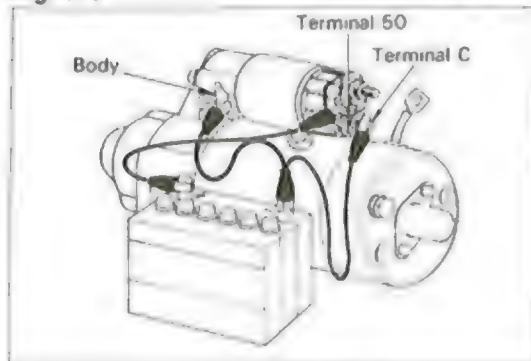


7. Tap in a new plug until it is even with the carburetor flange surface.

STARTING SYSTEM

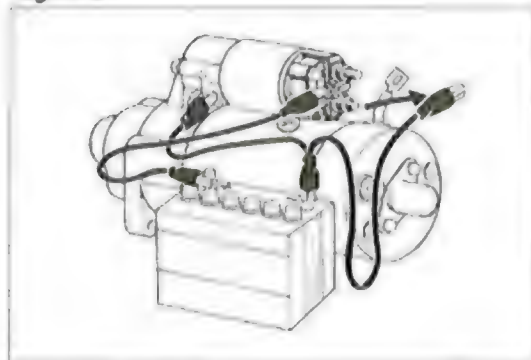
	Page
STARTING SYSTEM CIRCUIT	7-2
PERFORMANCE TEST	7-3
STARTER	7-6

Fig. 7-7



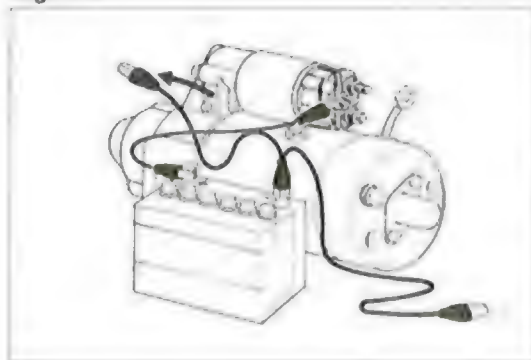
- 2 Pull-in test
Connect the magnetic switch to a battery as shown in the figure.
Negative side
Battery \ominus — Starter body and terminal C
Positive side
Battery \oplus — Terminal 50
If the pinion has definitely jumped out, the pull-in coil is satisfactory.

Fig. 7-8



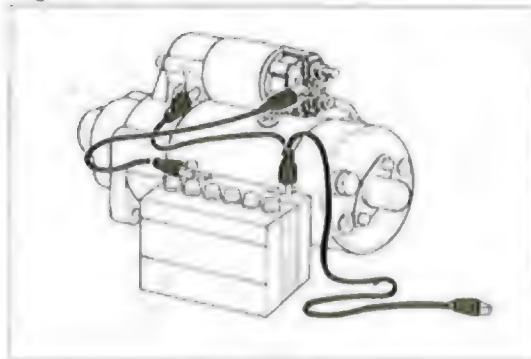
- 3 Hold-in test
Disconnect terminal C. The pinion should remain projected.

Fig. 7-9



- 4 Check the plunger return.
When disconnecting the switch body, the pinion should return quickly.

Fig. 7-10



- 5 Check pinion clearance.
(1) Connect the field coil lead to terminal C.
(2) Connect the magnetic switch to a battery as shown in the figure
Positive side
Battery \oplus — Terminal 50
Battery \ominus — Starter body

Fig. 7-11



- (3) Move the pinion to the armature side to eliminate slack, and check the clearance between the pinion and stop collar.

Clearance:

STD 0.1 – 4.0 mm
(0.004 – 0.157 in.)

Fig. 7-12



- (4) Adjust, if necessary, after loosening the lock nut.

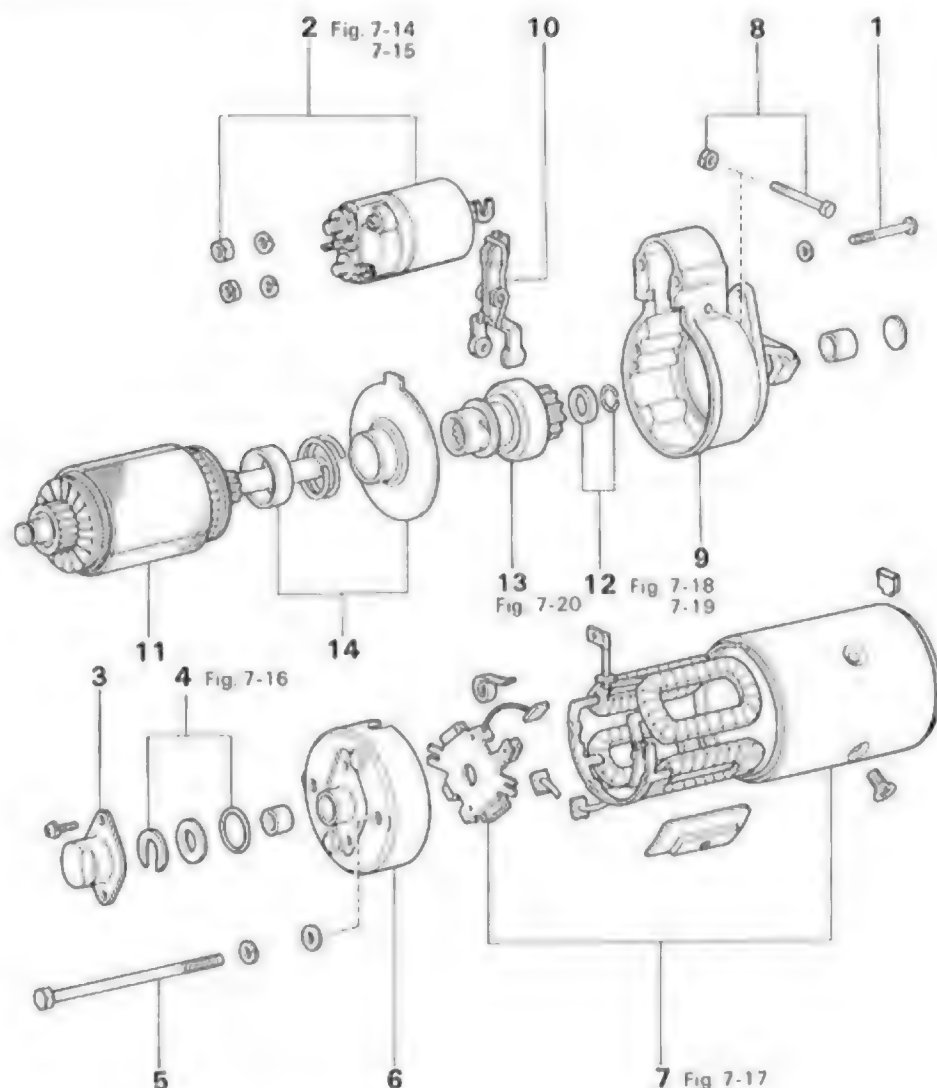
Clearance	Stud
Too large	→ Screw in
Too small	→ Screw out

STARTER

DISASSEMBLY

Disassemble the parts in the numerical order shown in the figure.

Fig. 7-13



- | | |
|--------------------------------|--|
| 1. Magnetic Switch Set Bolt | 8. Bolt |
| 2. Magnetic Switch Assembly | 9. Drive Housing |
| 3. Bearing Cover | 10. Drive Lever |
| 4. Lock Plate, O Ring & Rubber | 11. Armature |
| 5. Bolt | 12. Snap Ring & Stop Collar |
| 6. Commutator End Frame | 13. Clutch with Pinion Gear |
| 7. Yoke with Brush Holder | 14. Spring, Spring Holder & Center Bearing |

Fig. 7-14



Disconnect terminal C before removing the magnetic switch.

Fig. 7-15



Remove the magnetic switch as shown in the figure.

Fig. 7-16



Measure the armature shaft thrust clearance

Thrust clearance:

STD	0.05 – 1.00 mm (0.0020 – 0.0394 in.)
Limit	1.00 mm (0.0394 in.)

Fig. 7-17



Remove the brushes from the brush holder

Fig. 7-18



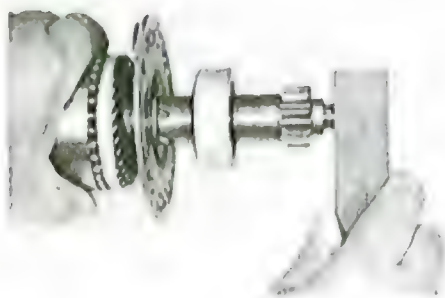
Tap in the stop collar with a screwdriver.

Fig. 7-19



Pry off the snap ring with a screwdriver and remove the stop collar.

Fig. 7-20



If the pinion was difficult to pull out, smoothen the shaft with an oil stone.

Fig. 7-21



INSPECTION & REPAIR

Commutator

Check for the following and repair or replace, if necessary.

1. Dirty or burnt surface
Correct with sandpaper if necessary.

Fig. 7-22

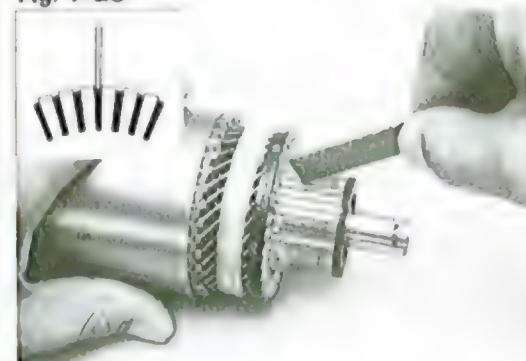


2. Depth of segment mica

Mica depth:

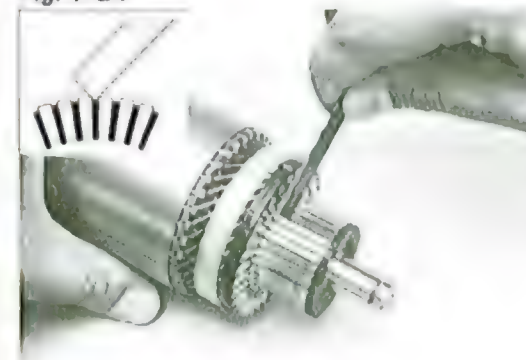
STD	0.4 – 0.8 mm (0.016 – 0.031 in.)
Limit	0.2 mm (0.008 in.)

Fig. 7-23



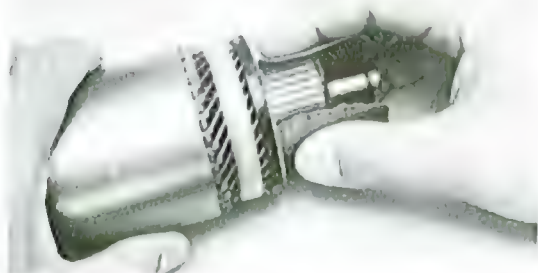
3. Repair the segment mica
(1) If the mica depth is below the limit, correct with a hacksaw blade.

Fig. 7-24



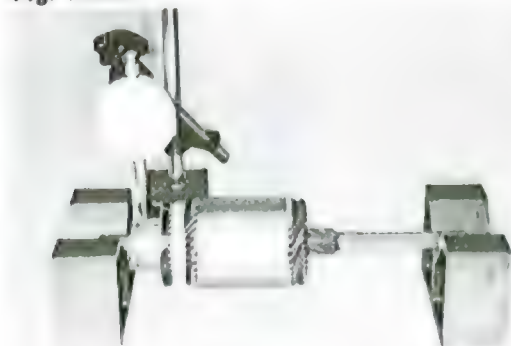
- (2) Smooth out the edges with a hacksaw blade.

Fig. 7-25



- (3) Use #400 sandpaper to smooth the commutator surface

Fig. 7-26



4. Runout
Correct on a lathe if it exceeds the limit

Runout:	
STD	Less than 0.1 mm (0.004 in.)
Limit	0.3 mm (0.012 in.)

Fig. 7-27



5. Surface wear
Replace the armature if below the limit

Commutator outer diameter:	
STD	32.7 mm (1.287 in.)
Limit	31 mm (1.22 in.)

Fig. 7-28



Armature Coil

1. Ground test
Check the commutator and armature coil core. If there is continuity, the armature is grounded and must be replaced

Fig. 7-29



2. Short circuit test
Place the armature on an armature tester and hold a hacksaw blade against the armature core while turning the armature. If the hacksaw blade is attracted or vibrates, the armature is shorted and must be replaced

Fig. 7-30



3. Solder condition
Check for continuity between the commutator and armature coil.

Fig. 7-31



Field Coil

1. Open circuit test
Check for continuity between the lead wire and soldered connection of the field coil brush. If there is no continuity, there is an open circuit in the field coil and it should be replaced

Fig. 7-32



2. Ground test
Check for continuity between the field coil end and field frame. If there is continuity, repair or replace the field coil.

Fig. 7-33



Brush
Measure the brush length and replace if below the limit

Brush length:

STD	19 mm (0.75 in.)
Limit	10 mm (0.39 in.)

Fig. 7-34



Brush Spring
Measure the brush spring load with a pull scale. If the reading is below the specified value, replace the spring

Tension: 1.02 – 1.38 kg
(2.2 – 3.0 lb)

– Note –
Take the pull scale reading at the very instant the brush spring separates from the brush.

Fig. 7-35



Brush Holder
Check the insulation between the ⊖ brush holder and ⊕ brush holder. Repair or replace, if continuity is indicated

Fig. 7-36



Drive Lever
Check the drive lever and spring for wear. Replace, if necessary.

Fig. 7-37



Starter Clutch & Pinion Gear

1. Check the spline teeth for wear or damage. Replace, if necessary.
2. Check the pinion for smooth movement.

Fig. 7-38



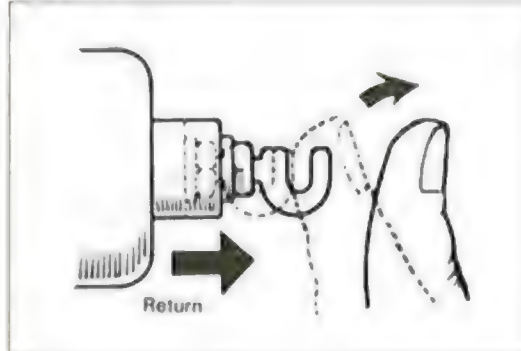
3. Check the pinion gear teeth and the chamfer for wear or damage

Fig. 7-39



4. Rotate the pinion. It should turn free in clockwise direction but lock when turned counterclockwise

Fig. 7-40



Magnetic Switch

1. Push in the plunger and release it. The plunger should return quickly to its original position.

Fig. 7-41



2. Measure and adjust the distance from the switch mounting surface to the stud end.

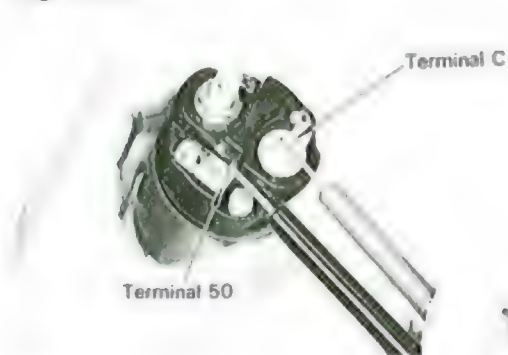
Moving stud length:

STD 34 mm

(1.34 in.)

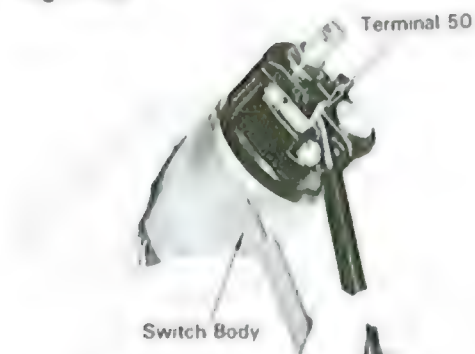
(Reference only)

Fig. 7-42



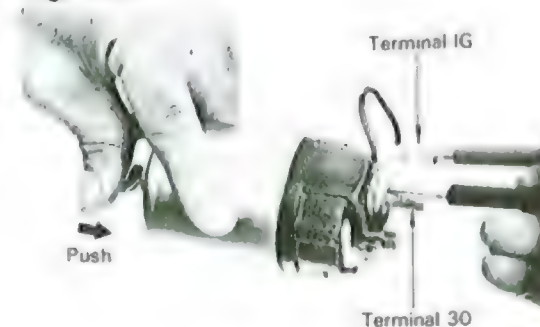
3. Pull-in coil open circuit test
Check for continuity between terminal 50 and terminal C.

Fig. 7-43



4. Hold-in coil open circuit test
Check for continuity between terminal 50 and the switch body.

Fig. 7-44



5. Terminal IG continuity test (N.S.W. & ECE FJ 40 series)
Push in plunger until it stops. Check for continuity between terminal 30 and the lead wire.

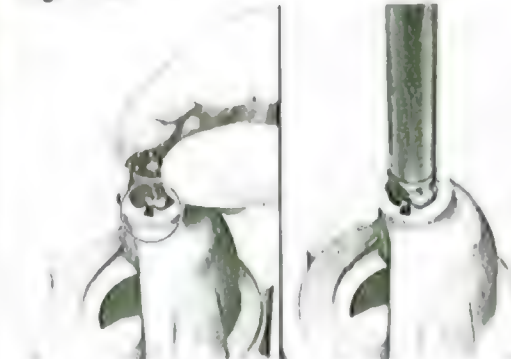
Fig. 7-45



Armature Shaft, Bushing & Center Bearing

1. Inspect the armature shaft, drive housing bushing and end frame bushing for wear or damage.

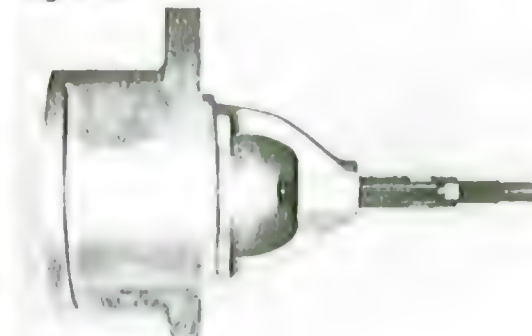
Fig. 7-46



2. Replace the drive housing bushing and end frame bushing if any contact is suspected.

- (1) Pry out the bushing cover and press out the bushing
- (2) Aligning the bushing hole with the housing groove, press in a new bushing.

Fig. 7-47



- (3) Ream the bushing to obtain the specified clearance

Bushing to shaft clearance:
0.035 – 0.077 mm
(0.0014 – 0.0030 in.)

Fig. 7-48



- (4) Temporarily assemble the parts
- (5) Make sure that the armature shaft rotates smoothly

Fig. 7-49



- (6) Clean the bore, install a new bushing cover and stake the housing at four positions.

Fig. 7-50



3. Inspect the spring holder, spring and center bearing for cracks, wear or damage. Replace, if necessary

ASSEMBLY

Assemble the parts in the numerical order shown in the figure.

Fig. 7-51

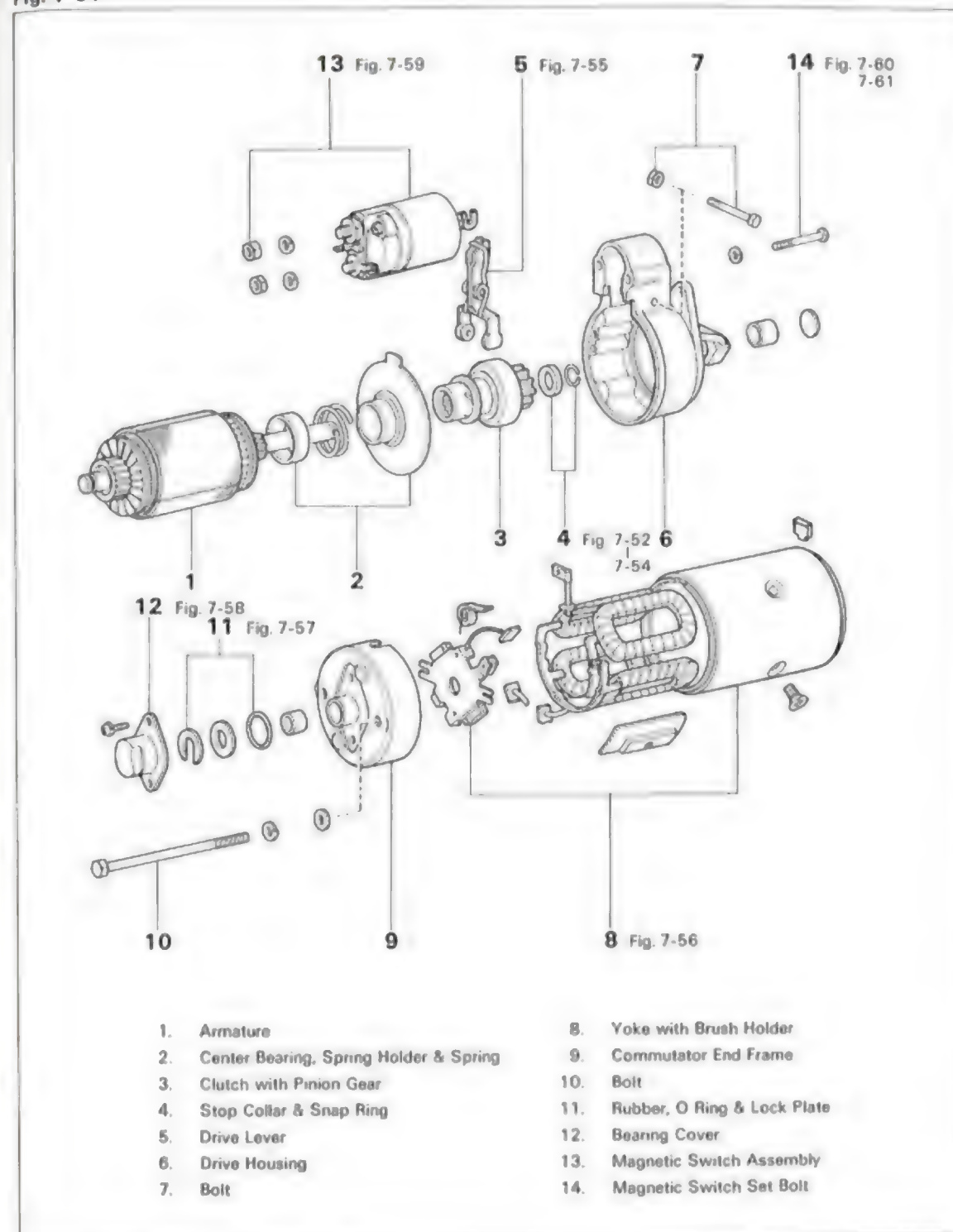
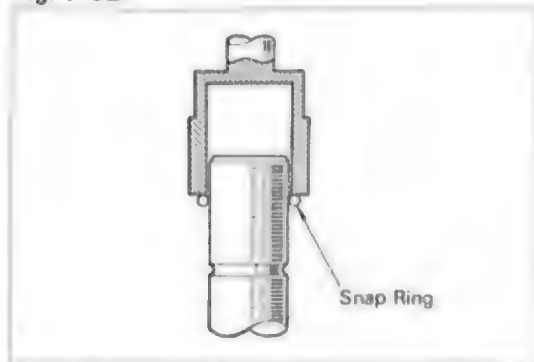
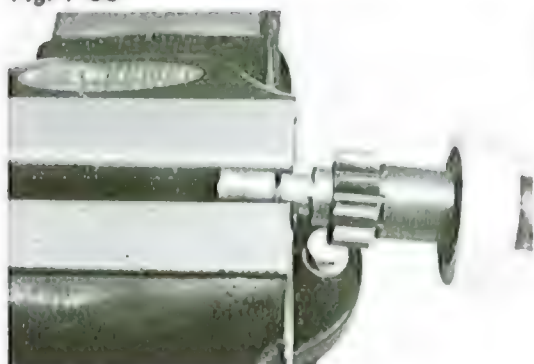


Fig. 7-52



Drive in the snap ring with a 14-mm socket wrench, and then fit it into the shaft groove.

Fig. 7-53



Compress the snap ring with a vise. Make sure that the snap ring fits correctly.

Fig. 7-54



Tap the pinion to slide the stop collar onto the snap ring.

Fig. 7-55



Install the drive lever.

— Note —

Assemble the drive lever in the manner shown in the figure.

Fig. 7-56



Assemble the brush holder, taking care not to damage the brushes or commutator.

Fig. 7-57



Install the lock plate and measure the armature shaft thrust clearance. If clearance exceeds the specified value, correct by increasing the number of shims.

Thrust clearance:

STD 0.05 – 1.00 mm
(0.0020 – 0.0394 in.)

Limit 1.00 mm
(0.0394 in.)

Adjusting shim thickness:
0.5 mm
(0.020 in.)

Fig. 7-58



Install the bearing cover.

— Note —

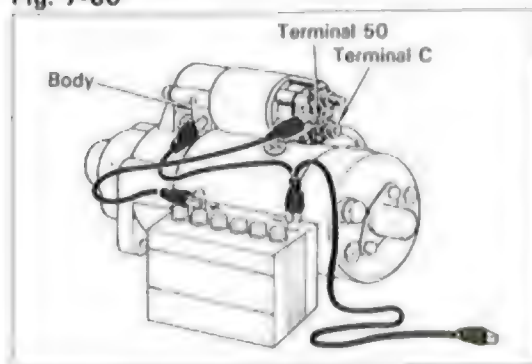
Refill the cover about 1/4 full with grease.

Fig. 7-59



Hook the magnetic switch onto the drive lever spring from underneath.

Fig. 7-60



Check the pinion clearance.

1. Connect the field coil lead to terminal C.
2. Connect the magnetic switch to a battery as shown in the figure

Positive side

Battery ⊕ —→ Terminal 50

Battery ⊖ —→ Starter body

Fig. 7-61



3. Move the pinion to the armature side to eliminate the slack, and check the clearance between the pinion end and stop collar

Clearance: 0.1 – 4.0 mm
(0.004 – 0.157 in.)

4. Adjust, if necessary, after loosening the lock nut

Clearance	Stud
Too large —→	Screw in
Too small —→	Screw out

IGNITION SYSTEM

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ON-VEHICLE INSPECTION	8-5
DISTRIBUTOR	
(FA & General FJ series)	8-11
(USA, ECE & Australia FJ series) ...	8-19
DISTRIBUTOR INSTALLATION	8-29

IGNITION SYSTEM CIRCUIT

Fig. 8-1

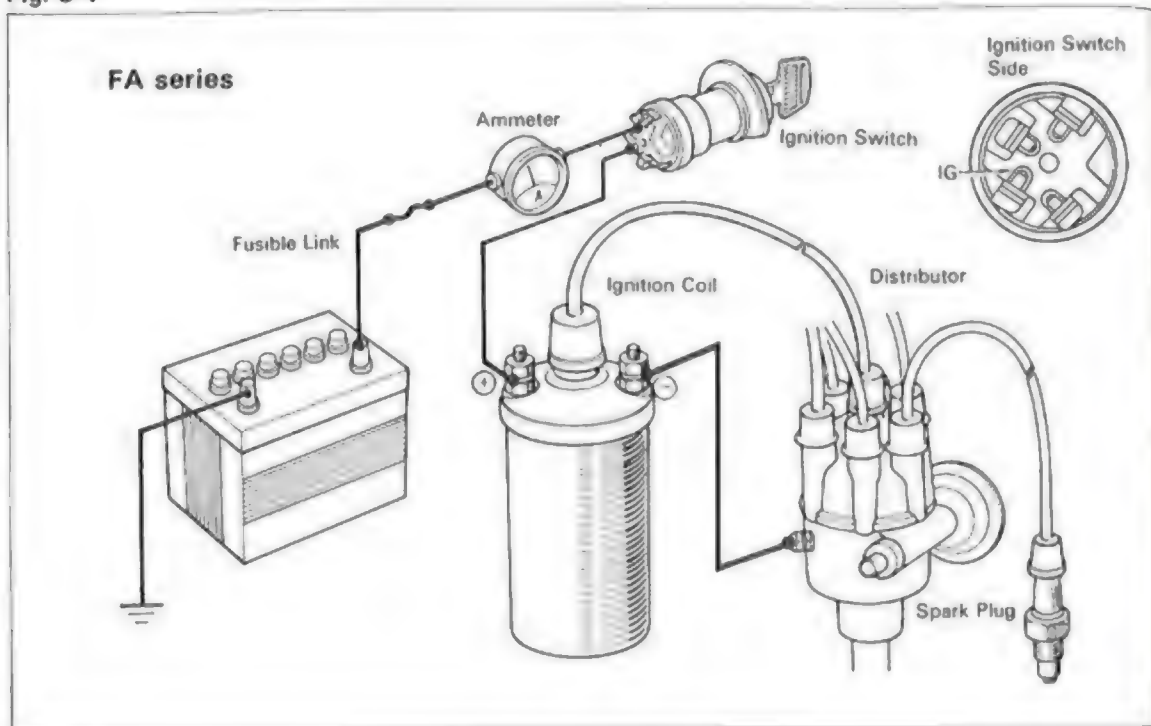


Fig. 8-2

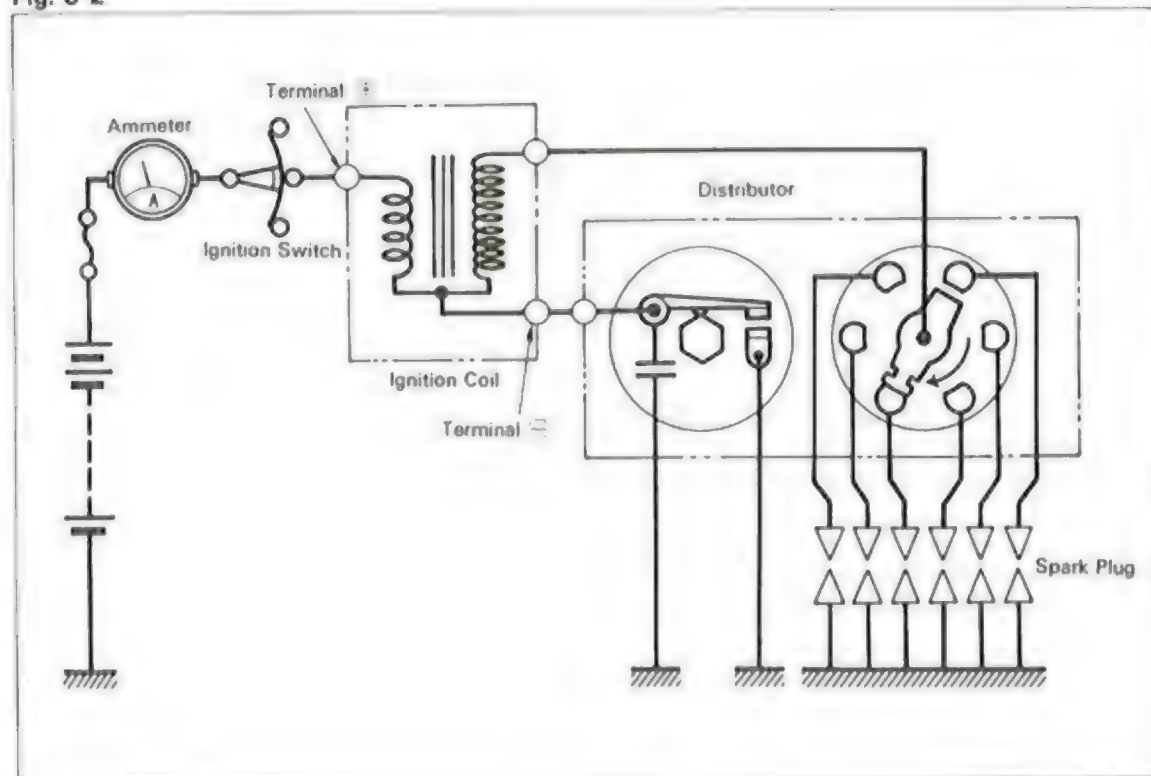


Fig. 8-3

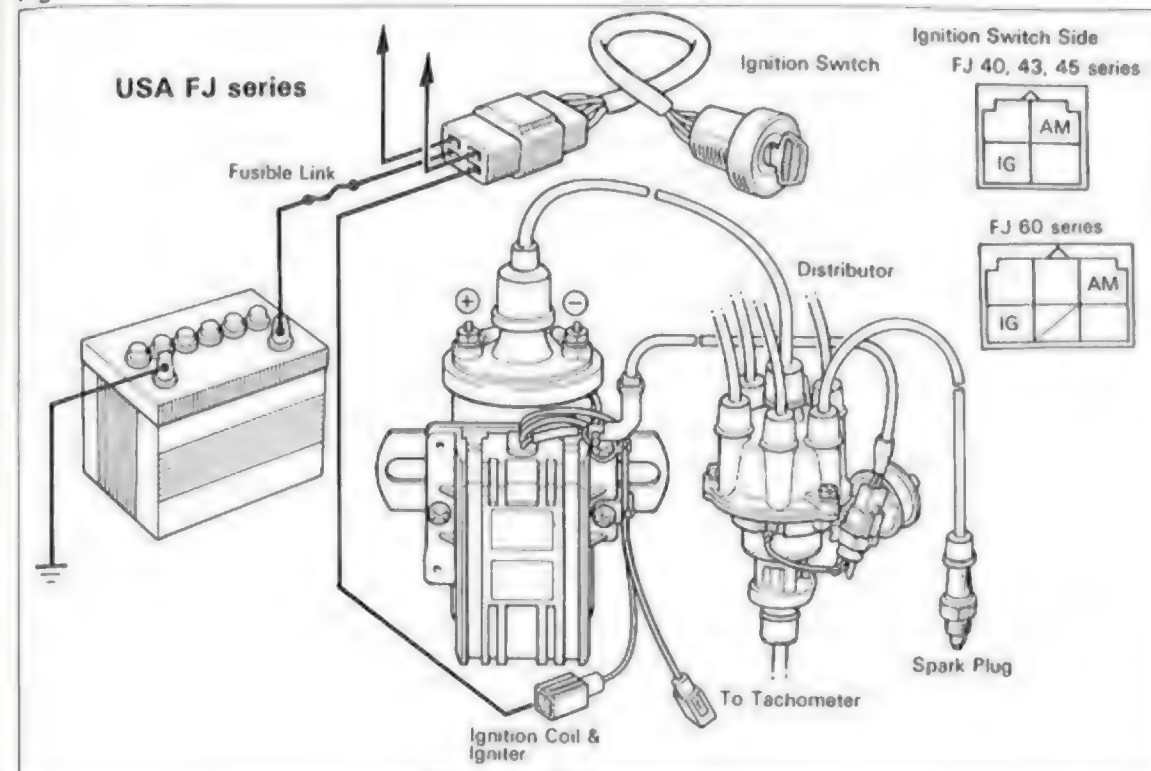


Fig. 8-4

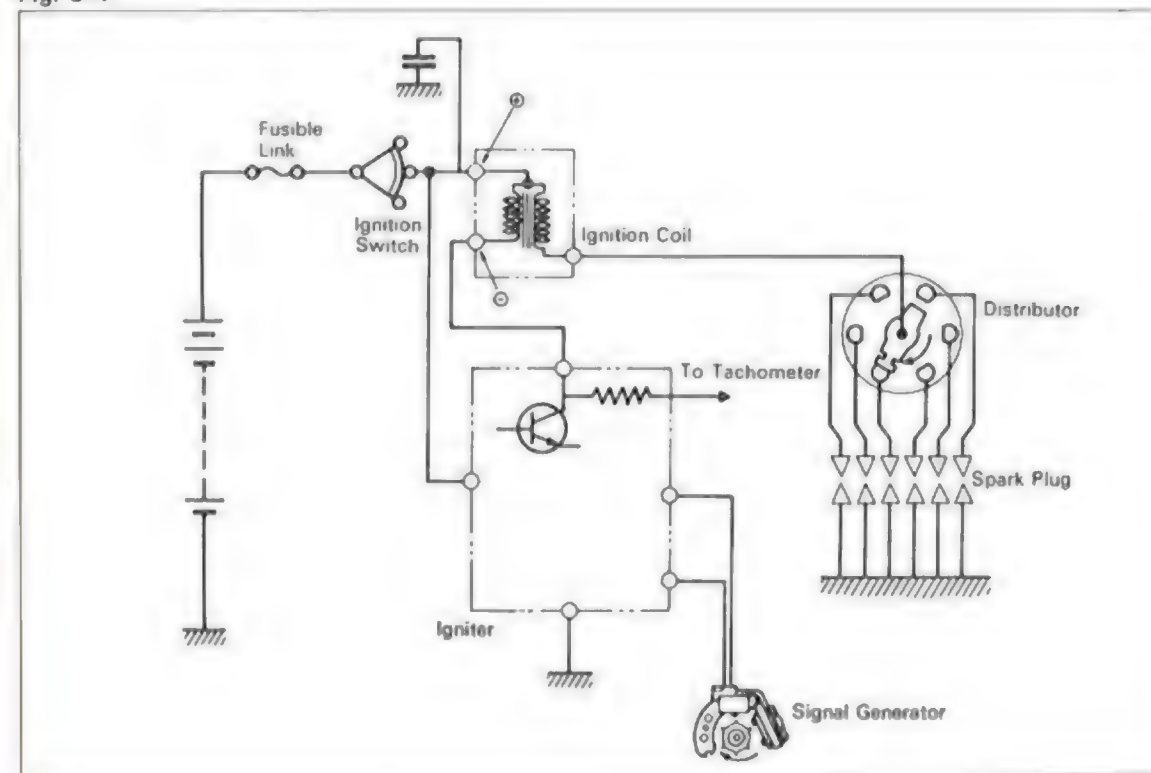


Fig. 8-5

ECE & Australia FJ series

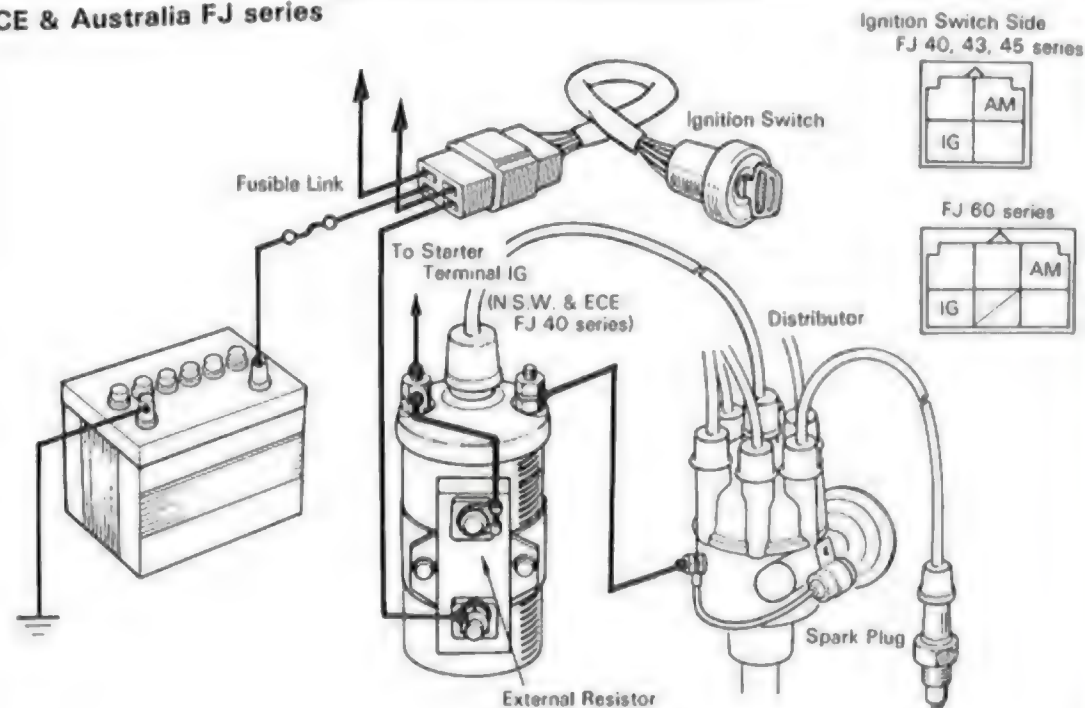


Fig. 8-6

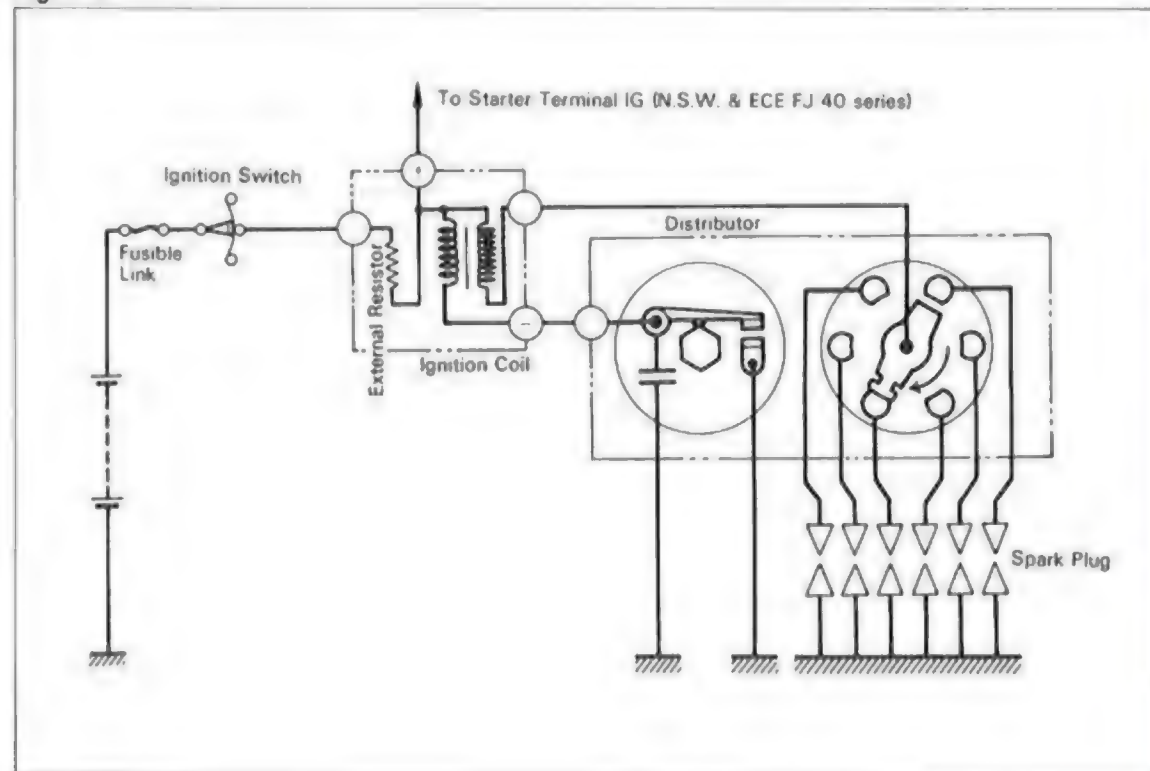
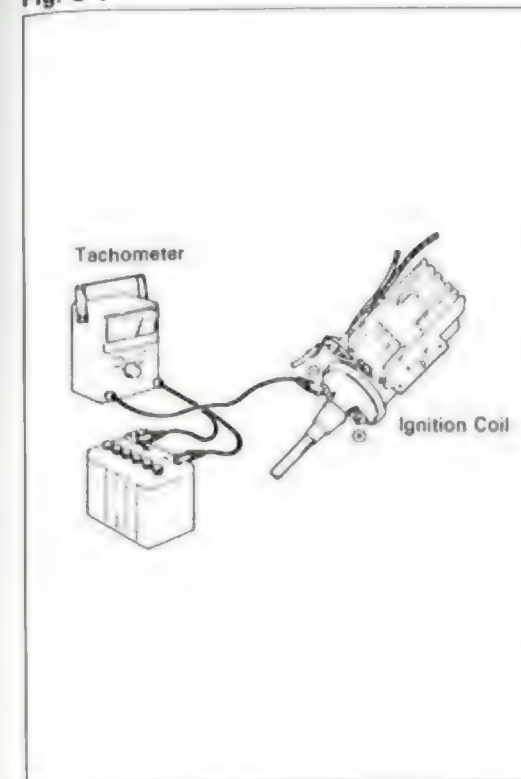


Fig. 8-7



ON-VEHICLE INSPECTION



Precautions

- For USA FJ series, caution should be taken with following items:
 - Do not leave the ignition switch ON for more than 10 minutes if the engine will not start
 - As some tachometers are not compatible with this ignition system, it is recommended that you consult with the manufacturer
 - NEVER allow the ignition coil terminals to touch ground as it could result in damage to the igniter and/or ignition coil
 - Do not disconnect the battery when the engine is running.
 - Make sure that the igniter is properly grounded to the body
 - When a tachometer is connected to the system, connect the tachometer \oplus terminal to the ignition coil \ominus terminal

Fig. 8-8

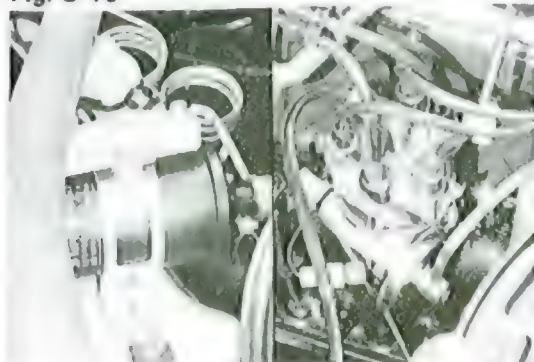
SEE
ENGINE TUNE-UP
BATTERY SECTION
Figs. 2-5 to 2-8

Fig. 8-9



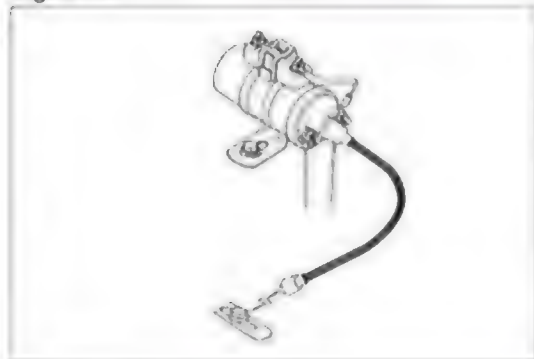
- Check the fuses and fusible links

Fig. 8-10



- 4 Check the installation of the wires and connectors, and check them for damage.

Fig. 8-11

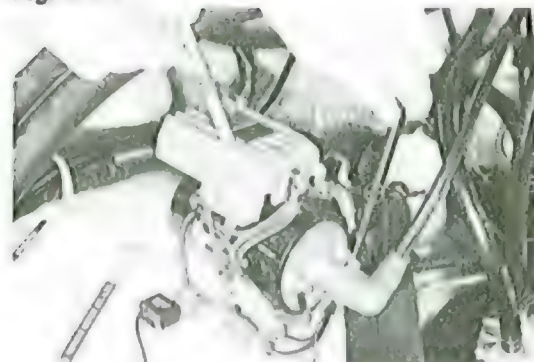


- 5 Check the spark condition.
 (1) Pull the distributor ignition coil resistive cord from the distributor.
 (2) Hold the cord end close to a ground.
 (3) Start the engine and check for spark.

— Caution —

This check must be made in as short a time as possible.

Fig. 8-12



Igniter (USA FJ series)

- 1 Turn the ignition switch to ON.
 2 Check the power SOURCE line voltage. Connect a voltmeter \oplus lead to the ignition coil \oplus terminal, and the \ominus lead to the igniter body.

Voltage: Approx. 12V

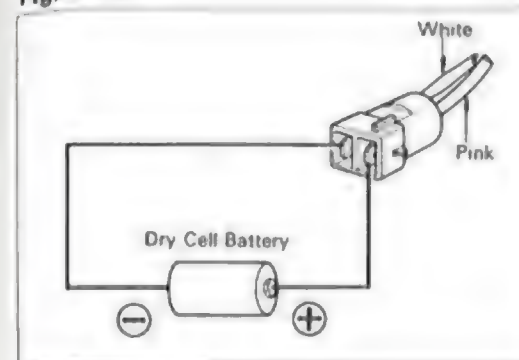
Fig. 8-13



- 3 Check the power transistor OFF condition. Connect a voltmeter \oplus lead to the ignition coil \ominus terminal, and the \ominus lead to the igniter body.

Voltage: Approx. 12V

Fig. 8-14



4. Check the power transistor ON condition.
 (1) Disconnect the wiring connector from the distributor.
 (2) Using a dry cell battery (1.5V), connect the positive pole to the pink wire terminal and the negative pole to the white wire terminal.

— Note —

This check must be made in as short a time as possible (less than 5 seconds).

Fig. 8-15

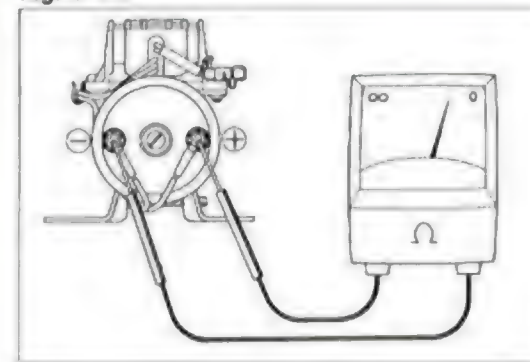


- (3) Connect a voltmeter \oplus lead to the ignition coil \ominus terminal, and the \ominus lead to the igniter body.

Voltage:

5V-Less than battery voltage

Fig. 8-16



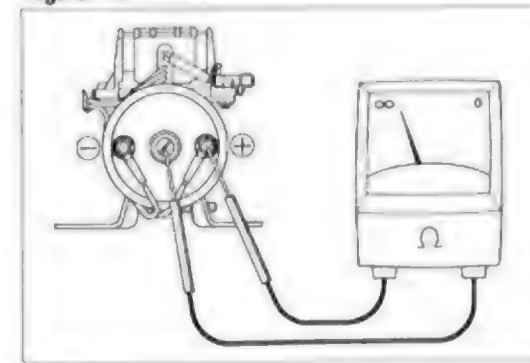
Ignition Coil (USA FJ series)

Check the ignition coil resistance with an ohmmeter.

1. Primary coil resistance between the \oplus and \ominus terminals.

Resistance: 0.5 — 0.7 Ω

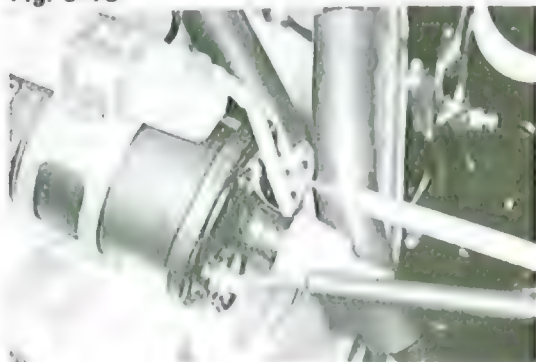
Fig. 8-17



2. Secondary coil resistance between the \oplus terminal and high tension terminal

Resistance: 11.5 — 15.5 k Ω

Fig. 8-18

**Ignition Coil (except USA FJ series)**

Check the ignition coil resistance with an ohmmeter

1. Primary coil resistance between the \oplus and \ominus terminals.

Resistance:

FA & General FJ series
1.2 – 1.5 Ω
ECE & Australia FJ series
1.3 – 1.6 Ω

Fig. 8-19

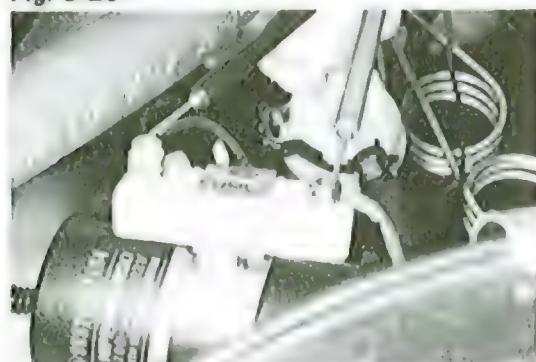


2. Secondary coil resistance between \oplus terminal and high tension terminal.

Resistance:

FA & General FJ series
8.5 – 11.5 k Ω
ECE & Australia FJ series
10.7 – 14.5 k Ω

Fig. 8-20

**Resistor (except USA FJ series & FA series)**

Check the resistor resistance with an ohmmeter.

Resistance: 1.3 – 1.5 Ω

Fig. 8-21

**HIGH TENSION CORD**

— Note —

1. Carefully remove the high tension cords by pulling on the rubber boots.

Fig. 8-22

Wrong



Correct



2. Do not bend the cords too sharply as the conductors will break.

Fig. 8-23

**INSPECTION**

1. Check the condition of the cord terminals. If any terminal is corroded, clean it. If broken or distorted, replace the cord.

Fig. 8-24



2. Check the resistance of each cord between both ends. If the reading exceeds the limit, replace the cord

Resistance:

Less than 25k Ω per cord

Fig. 8-25

**SPARK PLUG****INSPECTION**

1. Check for the following items:
 - (1) Cracks or damages in the threads or insulator
 - (2) Damaged or deteriorated gaskets.

Fig. 8-26



- (3) Wear on the electrodes.
- (4) Burnt electrode and the amount of carbon deposit.

2. Clean or replace the plugs, if necessary.

Fig. 8-27



ADJUST PLUG GAP

Check the plug gap with a plug gap gauge. If not as specified, adjust by bending the ground (outer) electrode.

Spark plug gap: 0.8 mm
(0.031 in.)

DISTRIBUTOR (FA & General FJ series)

DISASSEMBLY

Disassemble the parts in the numerical order shown in the figure.

Fig. 8-28

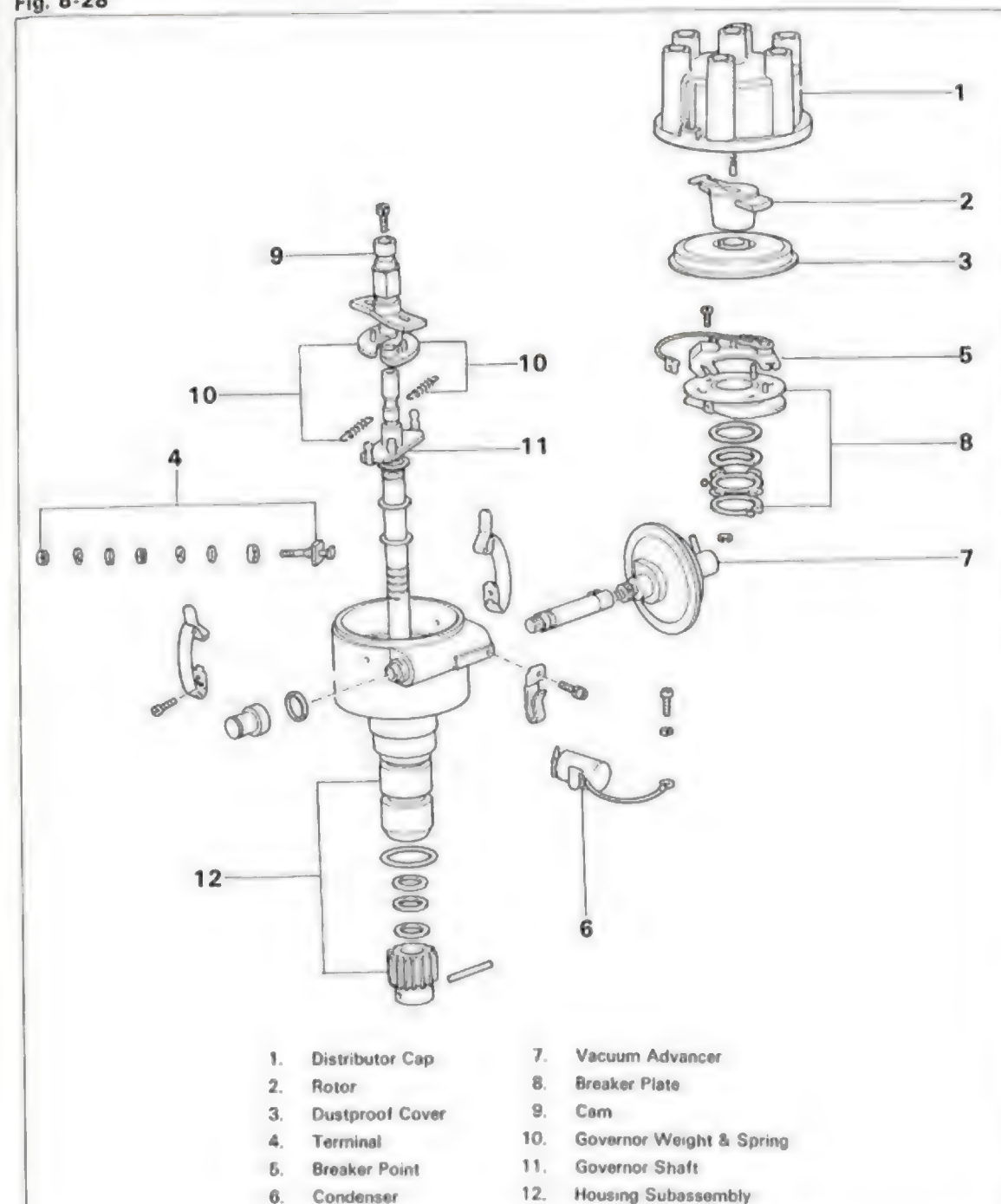
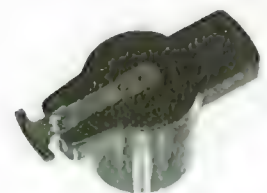


Fig. 8-29

**INSPECTION & REPAIR****Cap**

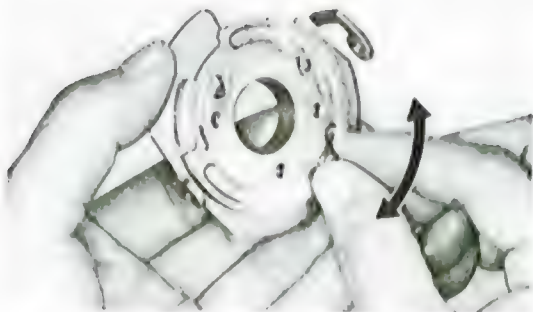
Check for cracks, carbon tracks, burnt or corroded terminals and check the center contact for wear.

Fig. 8-30

**Rotor**

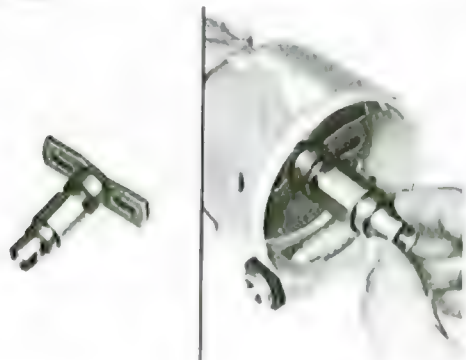
Check for cracks, carbon tracks, burnt or corroded terminals.

Fig. 8-31

**Breaker Plate**

Check for smooth rotation

Fig. 8-32

**Cam & Shaft**

1. Check the cam for wear or damage.
2. Check the fit between the cam and shaft.

Fig. 8-33

**Governor Weight & Pin**

1. Rotate the governor weight to check for binding
2. Check the governor weights for wear or damage

Fig. 8-34

**Vacuum Advancer Diaphragm**

Apply vacuum onto the vacuum advancer diaphragm. The diaphragm should move.

Fig. 8-35

**Governor Shaft & Housing**

1. Confirm that the governor shaft rotates smoothly.

Fig. 8-36

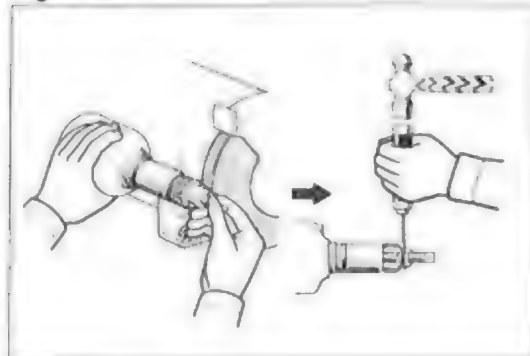


2. Check the shaft thrust clearance.

Thrust clearance:

0.15 – 0.50 mm
(0.0059 – 0.0197 in.)

Fig. 8-37



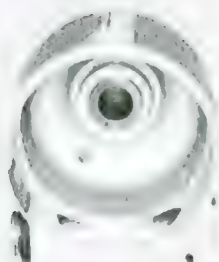
3. Disassemble the governor shaft.
(1) Scrape the peened end of the pin with a grinder and drive out the pin.

Fig. 8-38



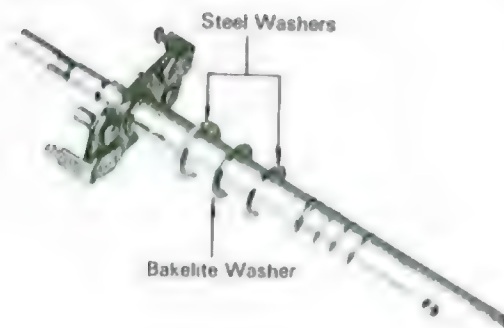
- (2) Check the governor shaft for wear or damage.

Fig. 8-39



- (3) Check the housing, bushing and O ring for wear, deformation or damage.

Fig. 8-40



- (4) Assemble the washers as shown in the figure (Cam side).

Fig. 8-41



- (5) Assemble the washers as shown in the figure (Spiral gear side).

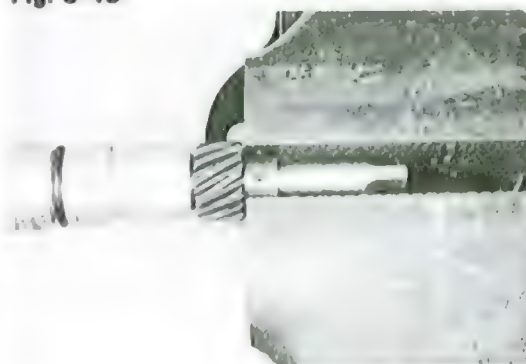
Fig. 8-42



- (6) Before staking the pin, recheck the shaft clearance.
If necessary, adjust the clearance with a steel washer.

Thrust clearance:
0.15 – 0.50 mm
(0.0059 – 0.0197 in.)

Fig. 8-43



- (7) Peen both ends with a vise.

ASSEMBLY

Assemble the parts in the numerical order shown in the figure.

Fig. 8-44

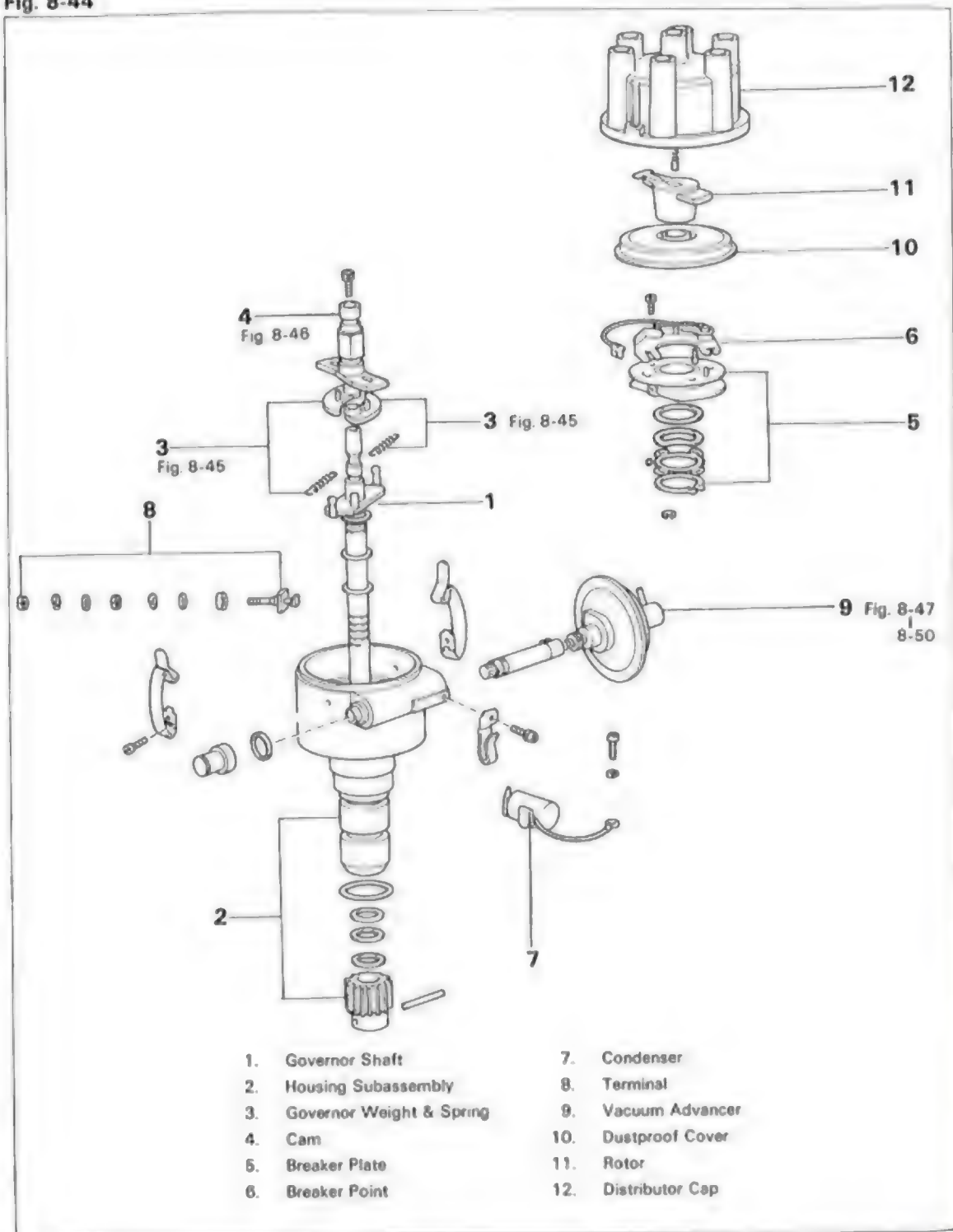


Fig. 8-45



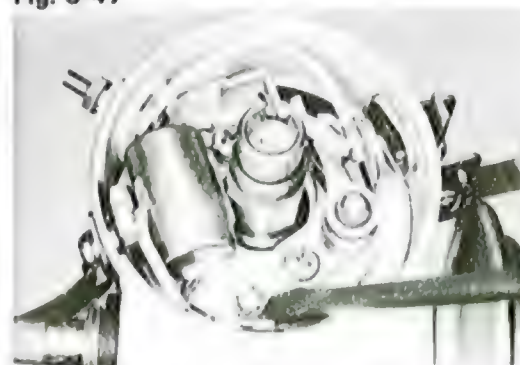
Make sure that the governor spring is installed correctly.

Fig. 8-46



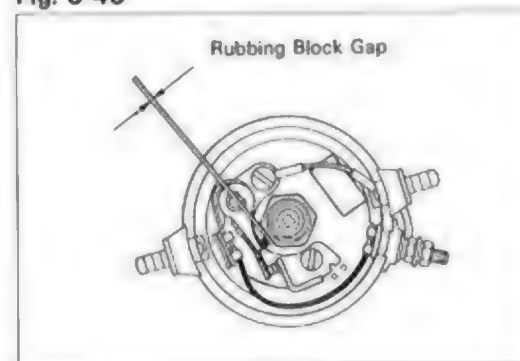
Install the cam, aligning its notch with the 4-mm hole of the spiral gear as shown in the figure.

Fig. 8-47



Make sure that the E ring is installed in the breaker plate correctly.

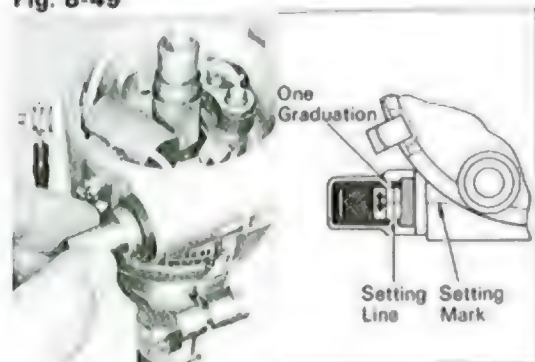
Fig. 8-48



Adjust the rubbing block gap.

Rubbing block gap: 0.30 mm
(0.0118 in.)

Fig. 8-49



Set the octane selector at the standard line.

Fig. 8-50



Check the breaker plate for smooth rotation by pushing the octane selector.

Fig. 8-51

SEE
DISTRIBUTOR
INSTALLATION
SECTION
Figs. 8-79 to 8-86

INSTALLATION

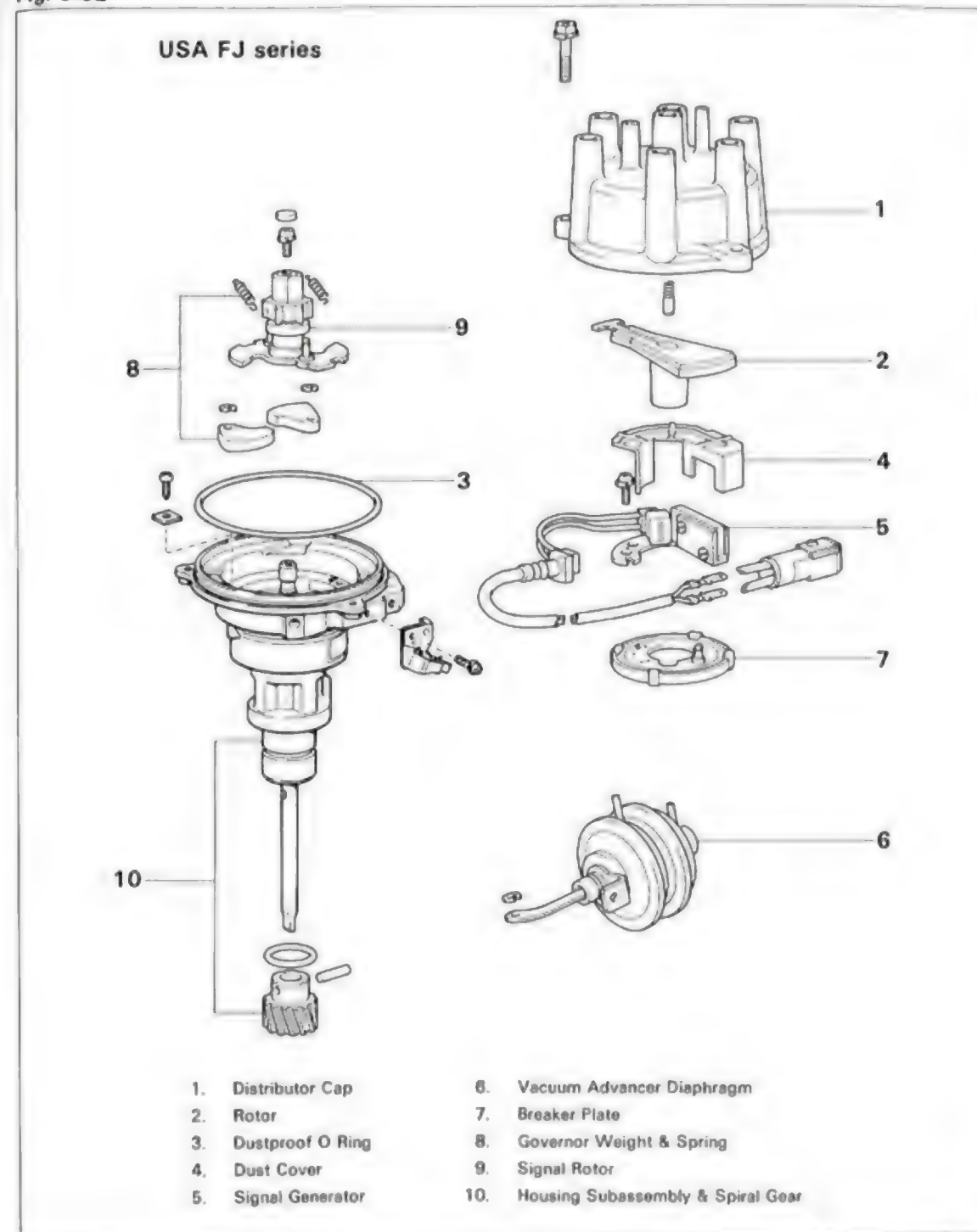
Install the distributor.

DISTRIBUTOR (USA, ECE & Australia FJ series)

DISASSEMBLY

Disassemble the parts in the numerical order shown in the figure

Fig. 8-52



Disassemble the parts in the numerical order shown in the figure.

Fig. 8-53

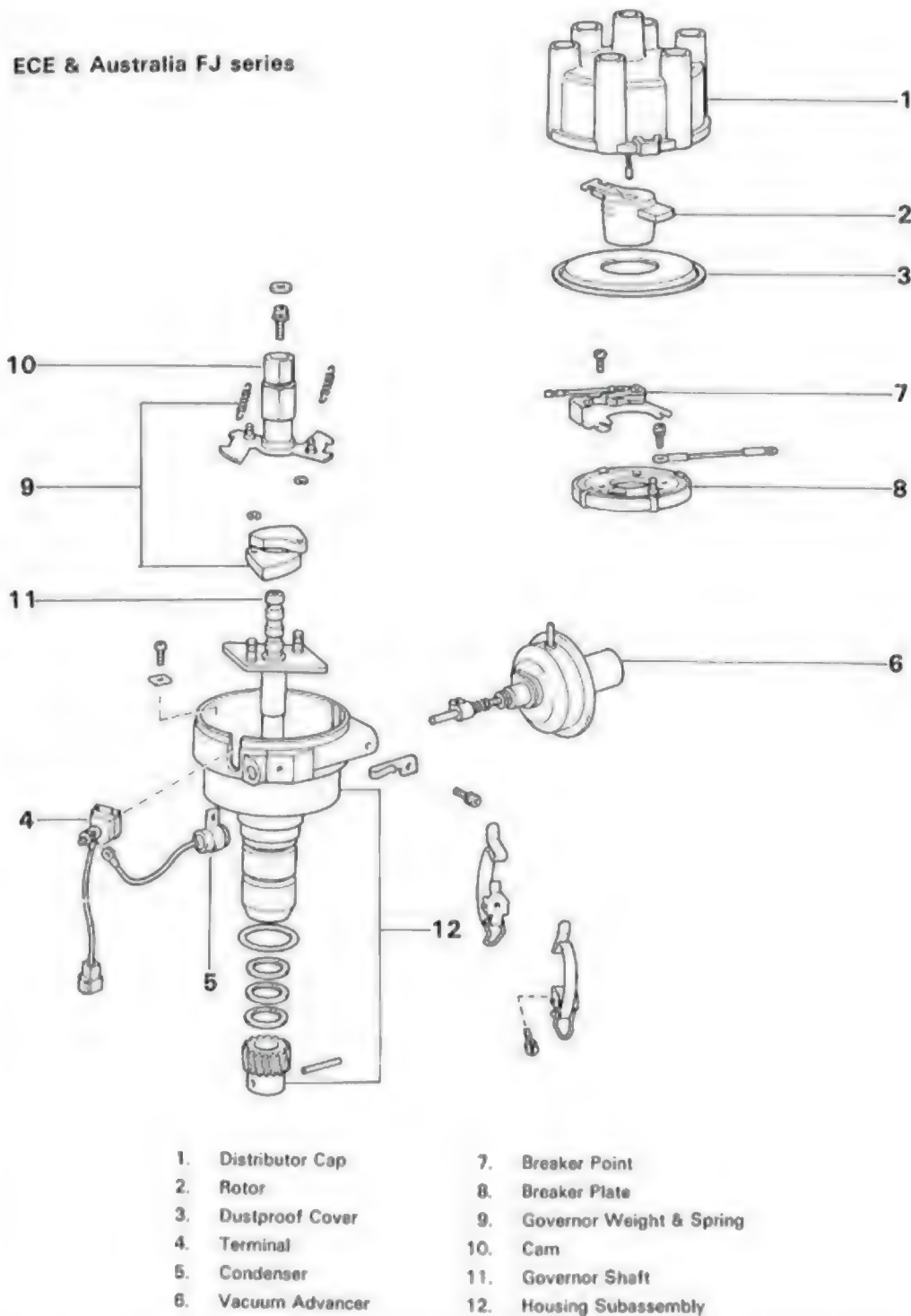


Fig. 8-54

**INSPECTION & REPAIR****Cap**

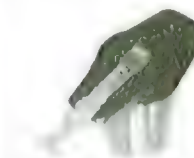
Check for cracks, carbon tracks, burnt or corroded terminals and check the center contact for wear.

Fig. 8-55

USA



ECE & Australia

**Rotor**

Check for cracks, carbon tracks, burnt or corroded terminals.

Fig. 8-56

**Breaker Plate**

Check for smooth rotation.



Fig. 8-57

**Cam & Shaft**

1. Check the cam for wear or damage.
2. Check the fit between the cam and shaft.

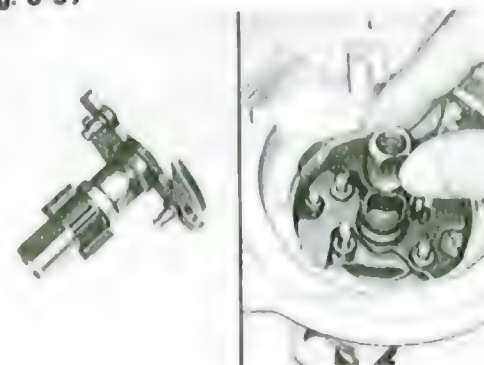
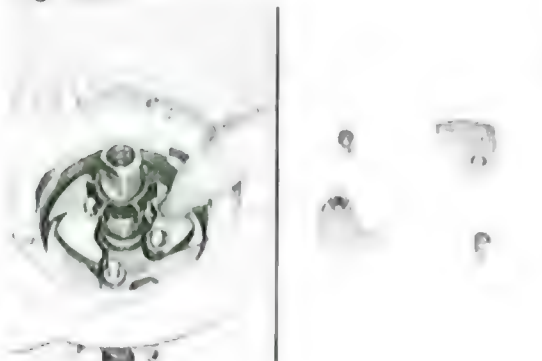


Fig. 8-58

**Governor Weight & Pin**

- 1 Rotate the governor weight to check for binding.
- 2 Check the governor weights and bearings for wear or damage.

Fig. 8-59

**Vacuum Advancer Diaphragm**

Apply vacuum onto the vacuum advancer diaphragm. The diaphragm should move.

Fig. 8-60

**Governor Shaft & Housing**

- 1 Confirm that the governor shaft rotates smoothly.

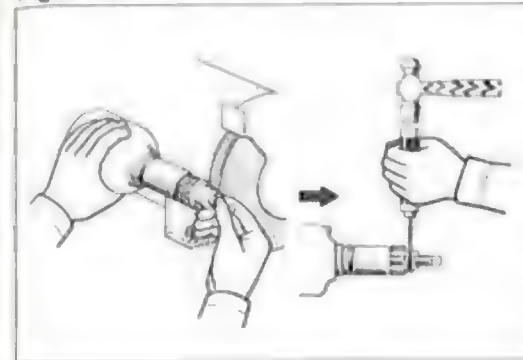
Fig. 8-61



2. Check the shaft thrust clearance. (ECE & Australia)

Thrust clearance:
 0.15 – 0.50 mm
 (0.0059 – 0.0197 in.)

Fig. 8-62



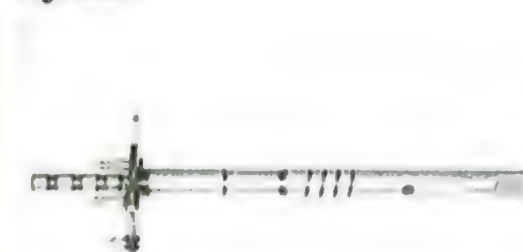
3. Disassemble the governor shaft referring to the following procedures (ECE & Australia)

(1) Scrape the peened end of the pin with a grinder and drive out the pin.

— Note —

Do not disassemble the governor shaft of USA distributor. But replace the spiral gear if necessary.

Fig. 8-63



- (2) Check the governor shaft for wear or damage. (ECE & Australia)

Fig. 8-64

USA



- (3) Check the housing, bushing and O ring for wear, deformation or damage

Fig. 8-65

ECE & Australia

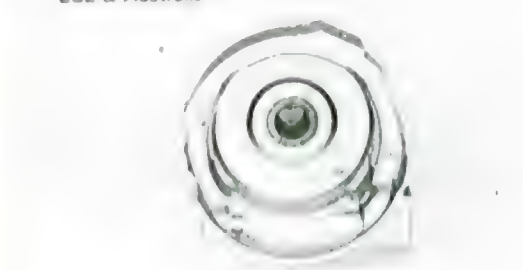
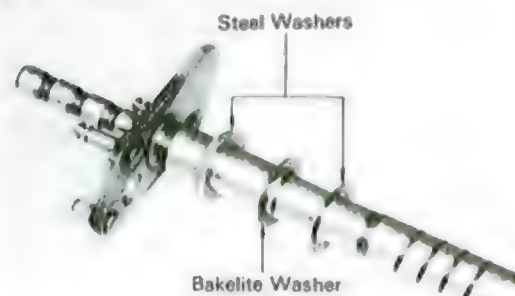


Fig. 8-66



- (4) Assemble the washers (cam side) as shown in the figure. (ECE & Australia)

Fig. 8-67



- (5) Assemble the washers (spiral gear side) as shown in the figure. (ECE & Australia)

Fig. 8-68



- (6) Before staking the pin, recheck the shaft clearance. If necessary, adjust the clearance with a steel washer. (ECE & Australia)

Thrust clearance:
0.15 – 0.50 mm
(0.0059 – 0.0197 in.)

Fig. 8-69



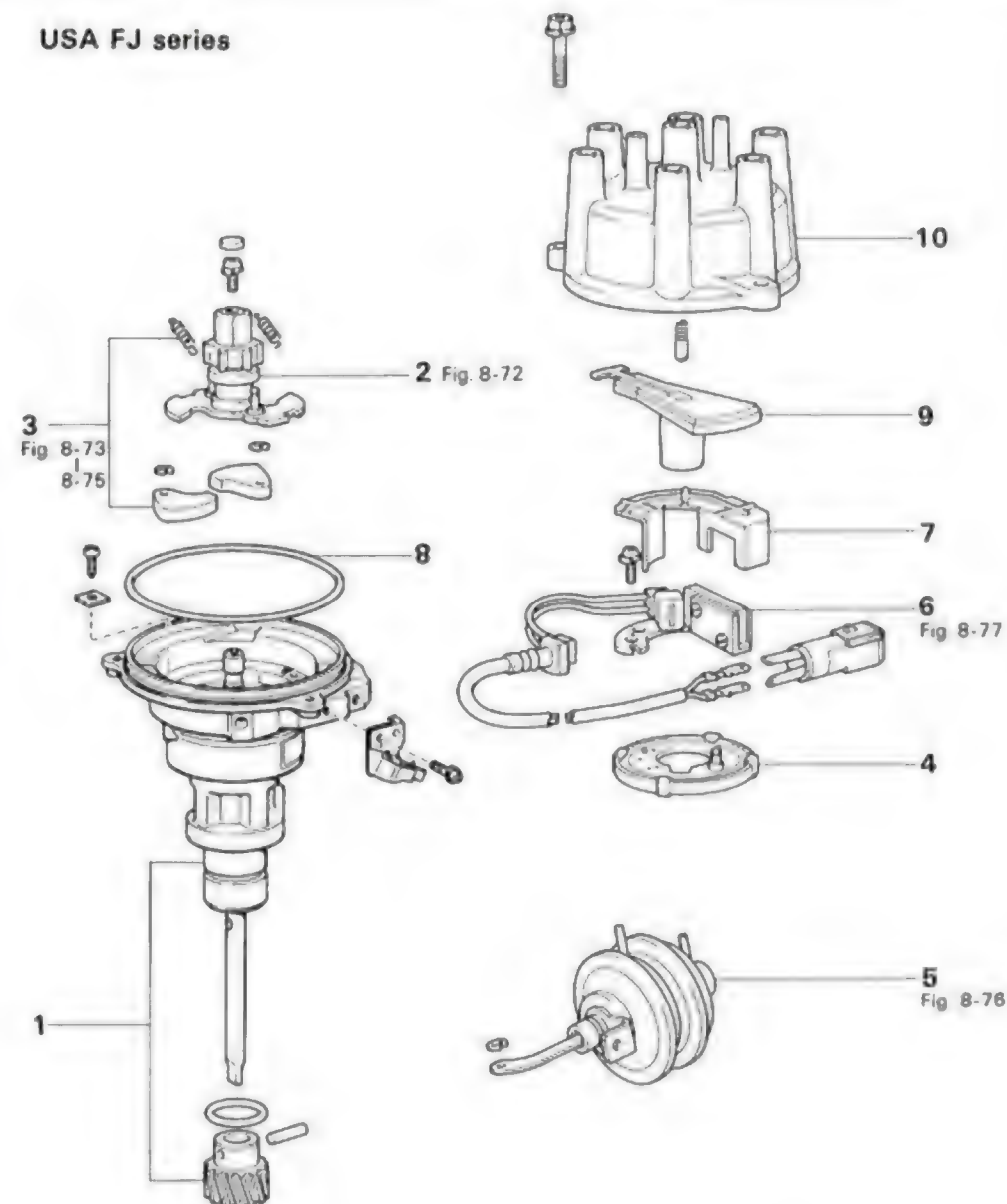
- (7) Using a suitable metal plate, peen both ends of the pin.

ASSEMBLY

Assemble the parts in the numerical order shown in the figure

Fig. 8-70

USA FJ series



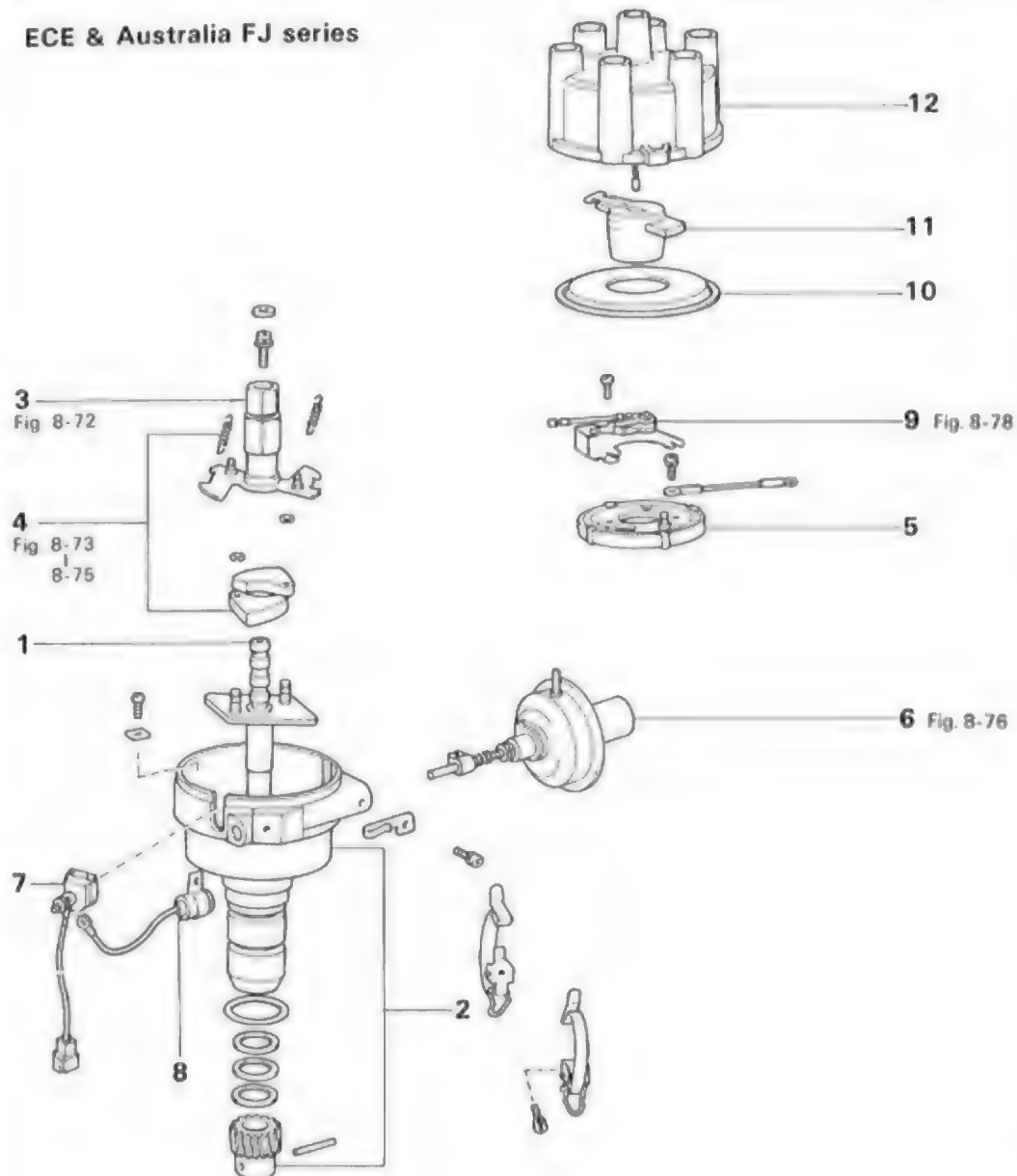
1. Housing Subassembly & Spiral Gear
2. Signal Rotor
3. Governor Weight & Spring
4. Breaker Plate
5. Vacuum Advancer Diaphragm

6. Signal Generator
7. Dust Cover
8. Dustproof O Ring
9. Rotor
10. Distributor Cap

Assemble the parts in the numerical order shown in the figure

Fig. 8-71

ECE & Australia FJ series



- | | |
|-----------------------------|---------------------|
| 1. Governor Shaft | 7. Terminal |
| 2. Housing Subassembly | 8. Condenser |
| 3. Cam | 9. Breaker Point |
| 4. Governor Weight & Spring | 10. Dustproof Cover |
| 5. Breaker Plate | 11. Rotor |
| 6. Vacuum Advancer | 12. Distributor Cap |

Fig. 8-72



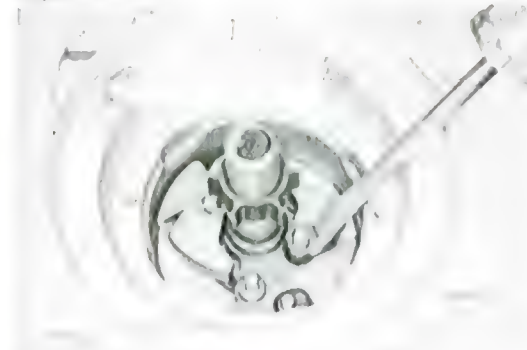
Match the 10.5 mark (USA) or the 10 mark (ECE & Australia) with the stopper and fit on the cam.

Fig. 8-73



Install the bearing into the pin hole.

Fig. 8-74



Make sure that the E ring is correctly installed in the groove

Fig. 8-75



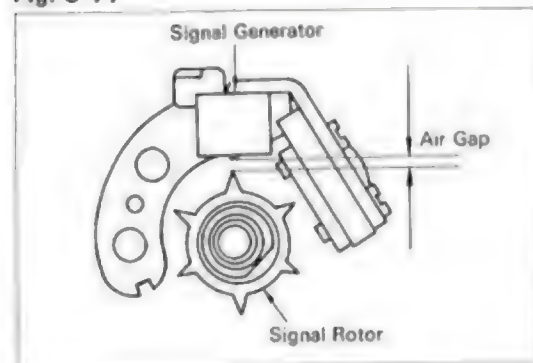
Make sure that the governor spring is installed correctly.

Fig. 8-76



Make sure that the E ring is correctly installed in the breaker plate. (USA)

Fig. 8-77



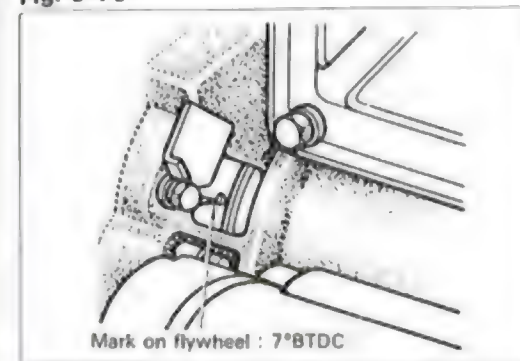
Adjust the air gap. (USA)
Air gap: 0.2 – 0.4 mm
(0.008 – 0.016 in.)

Fig. 8-78



Adjust the rubbing block gap. (ECE & Australia)
Rubbing block gap: 0.30 mm
(0.0118 in.)

Fig. 8-79

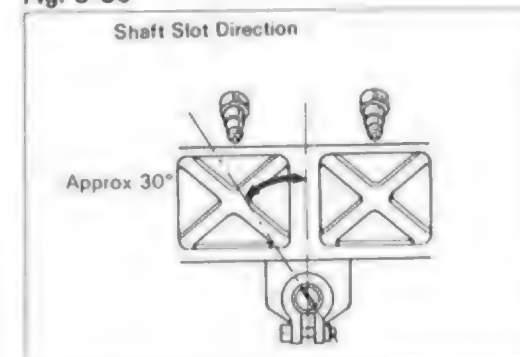


DISTRIBUTOR INSTALLATION

FA & GENERAL FJ SERIES

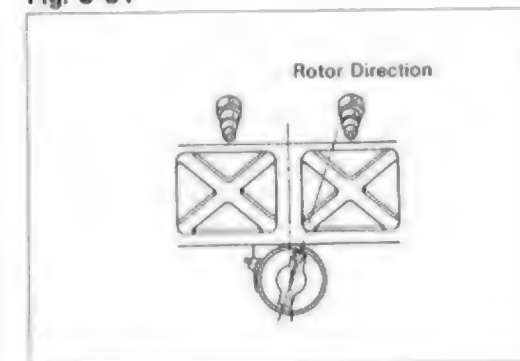
1. Set the No.1 cylinder to the ignition timing position

Fig. 8-80



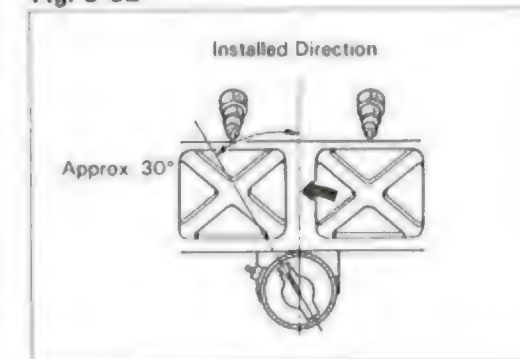
2. Set the oil pump shaft slot in the direction shown in the figure.

Fig. 8-81



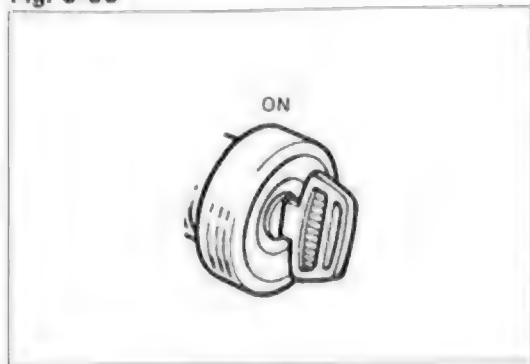
3. Begin insertion of the distributor with the rotor pointing as shown in the figure.

Fig. 8-82



4. When fully installed, the rotor should point as shown in the figure.

Fig. 8-83

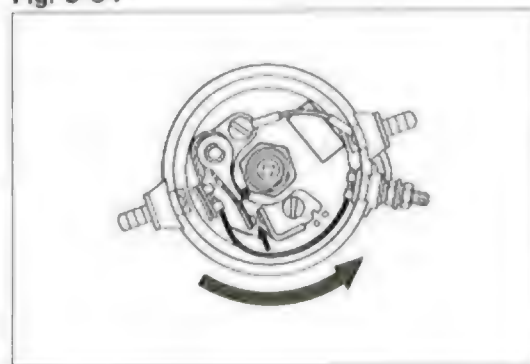


5. Turn the ignition switch to ON.

— Note —

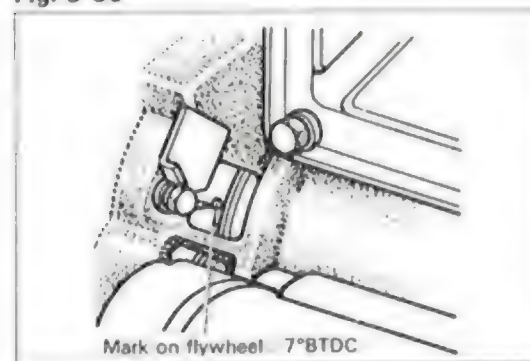
Do not crank the starter motor.

Fig. 8-84



6. Rotate the distributor body counterclockwise until a spark jumps between the points and tighten the clamp bolt in that position.

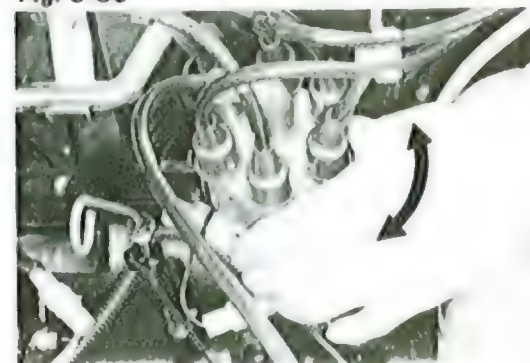
Fig. 8-85



7. Check the ignition timing at idle speed

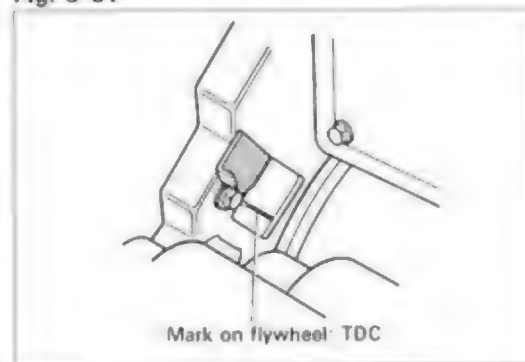
Ignition timing:
7° BTDC/Max. 950 rpm

Fig. 8-86



8. If necessary, align the timing ball with the pointer by turning the distributor body.

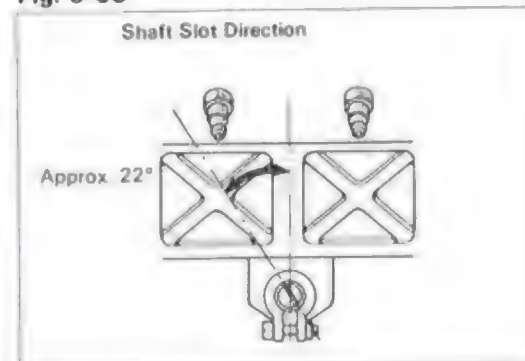
Fig. 8-87



USA FJ SERIES

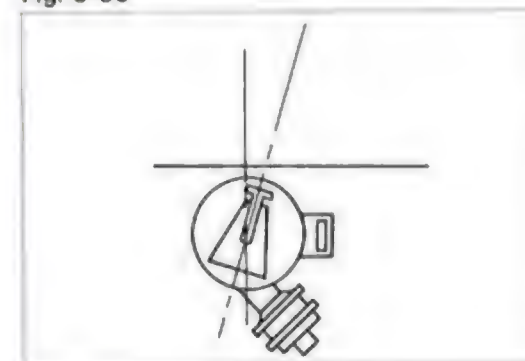
1. Set the No. 1 cylinder to TDC/compression

Fig. 8-88



2. Set the oil pump shaft slot in the direction shown in the figure

Fig. 8-89

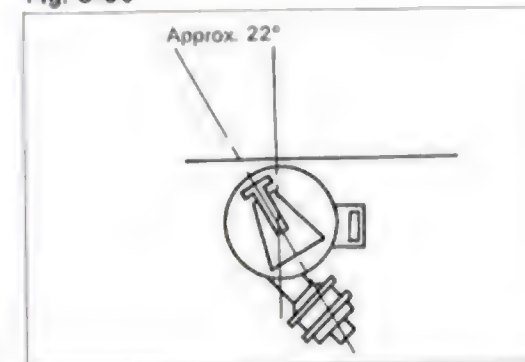


3. Begin insertion of the distributor with the rotor pointing as shown in the figure.

— Note —

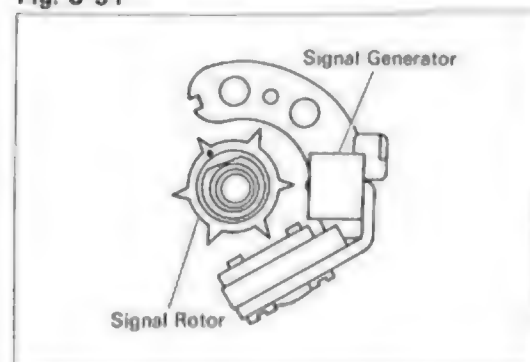
Align the flange center with the screw hole center.

Fig. 8-90



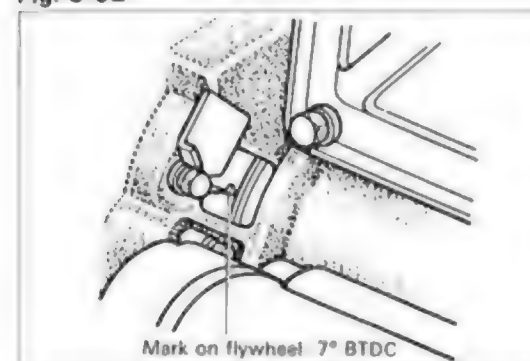
4. When fully installed, the rotor should point as shown in the figure.

Fig. 8-91



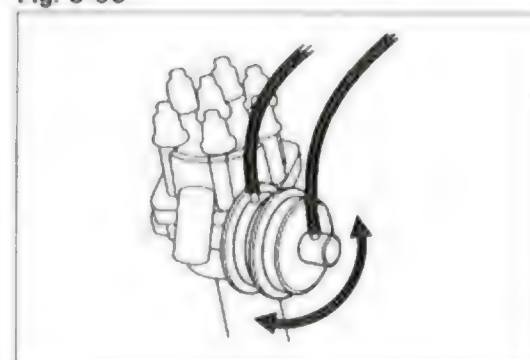
- 5 Align the rotor tooth with the signal generator and tighten the clamp bolt in that position.

Fig. 8-92



6. Check the ignition timing at idle speed.
 Ignition timing:
 7° BTDC/650 rpm

Fig. 8-93



7. If necessary, align the timing ball with the pointer by turning the distributor body

CHARGING SYSTEM

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CHARGING SYSTEM CIRCUIT

FJ series (Tirrell Regulator Type)

Fig. 9-1

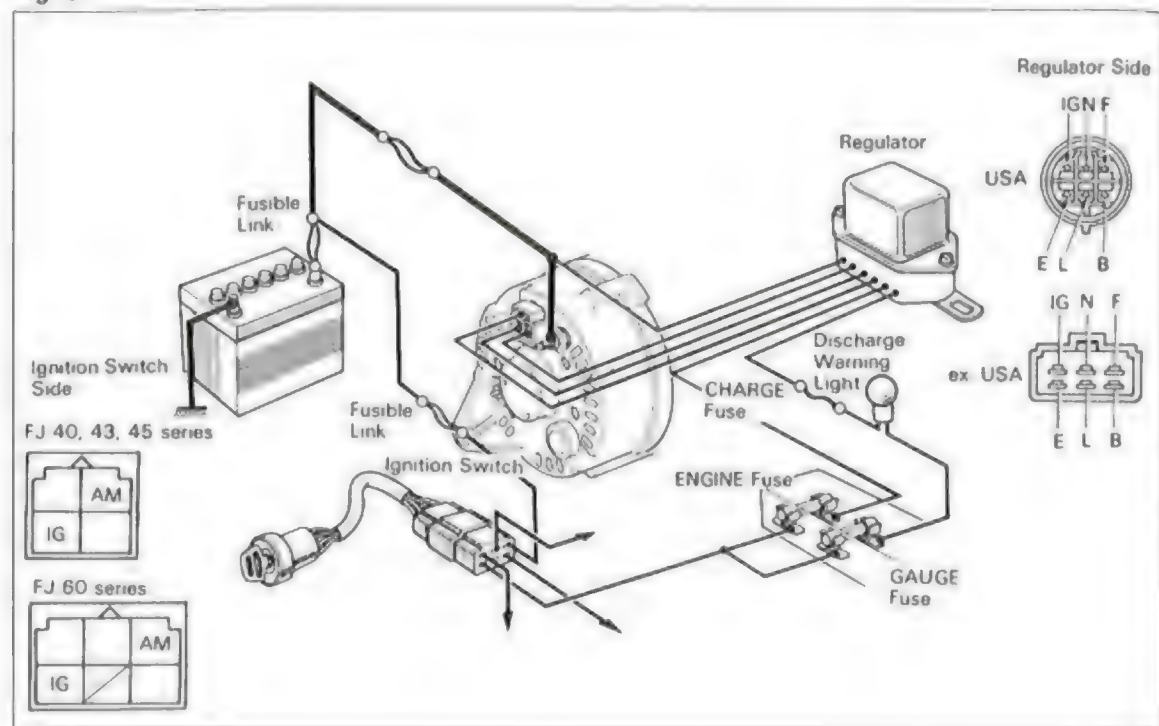
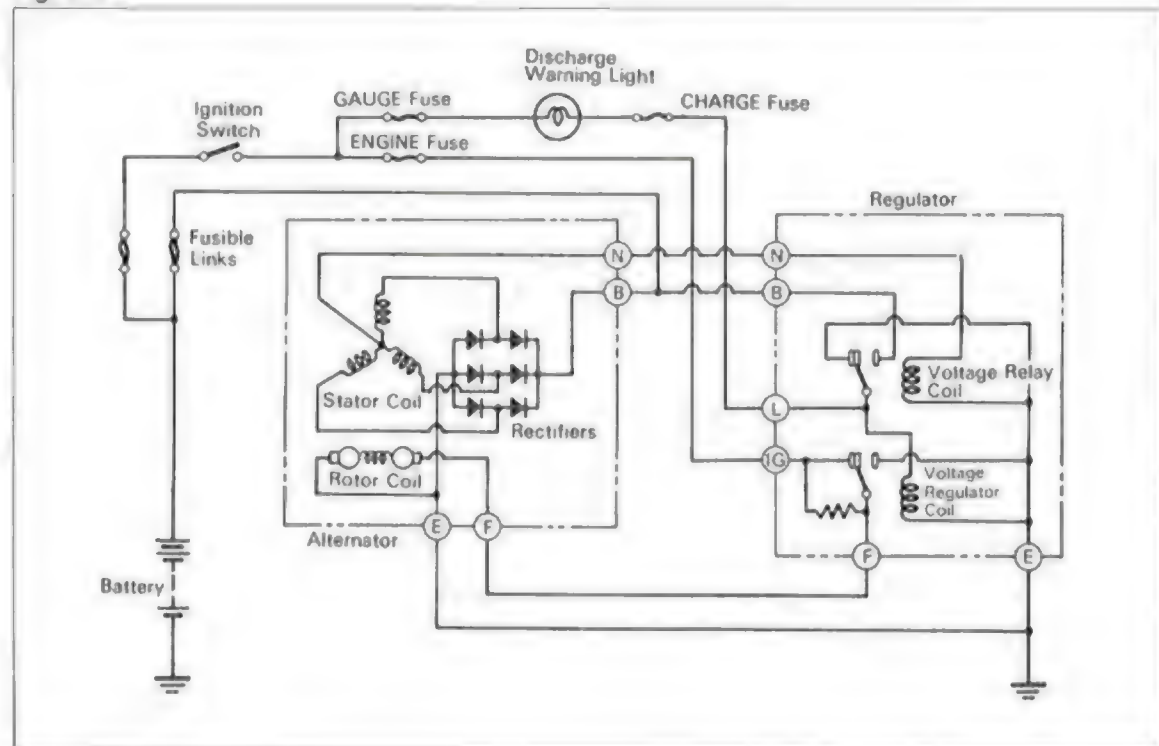


Fig. 9-2



FJ 60 series (IC Regulator Type)

Fig. 9-3

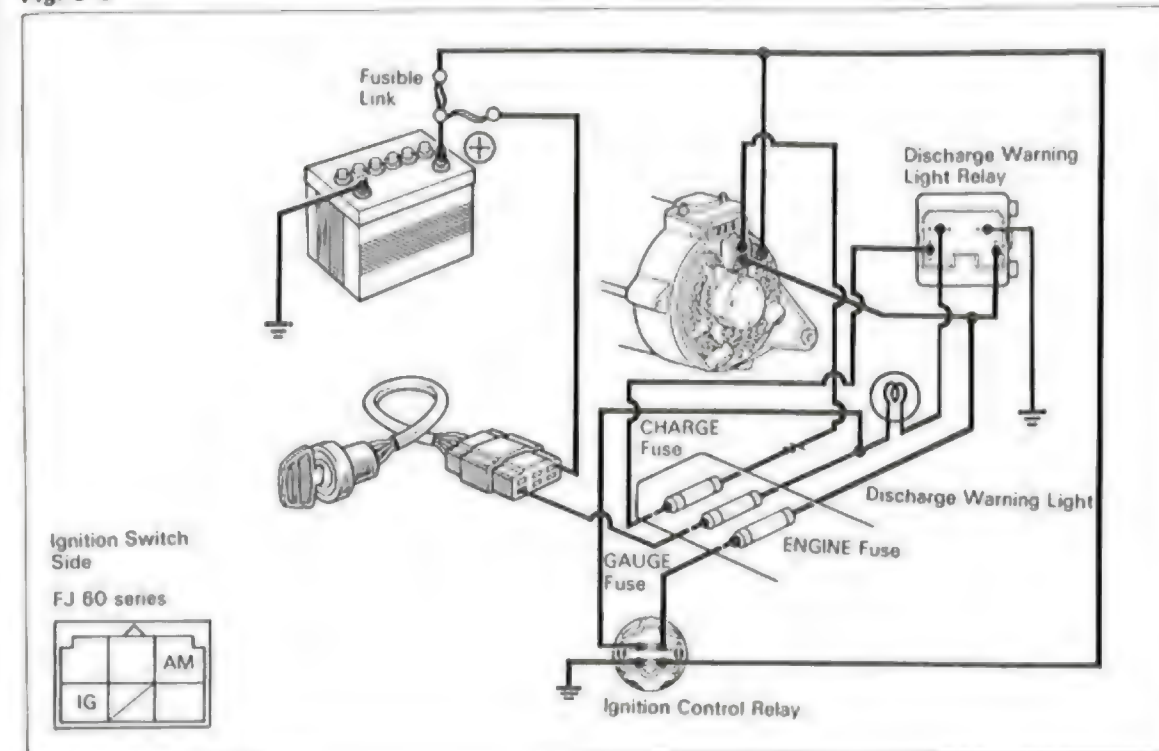
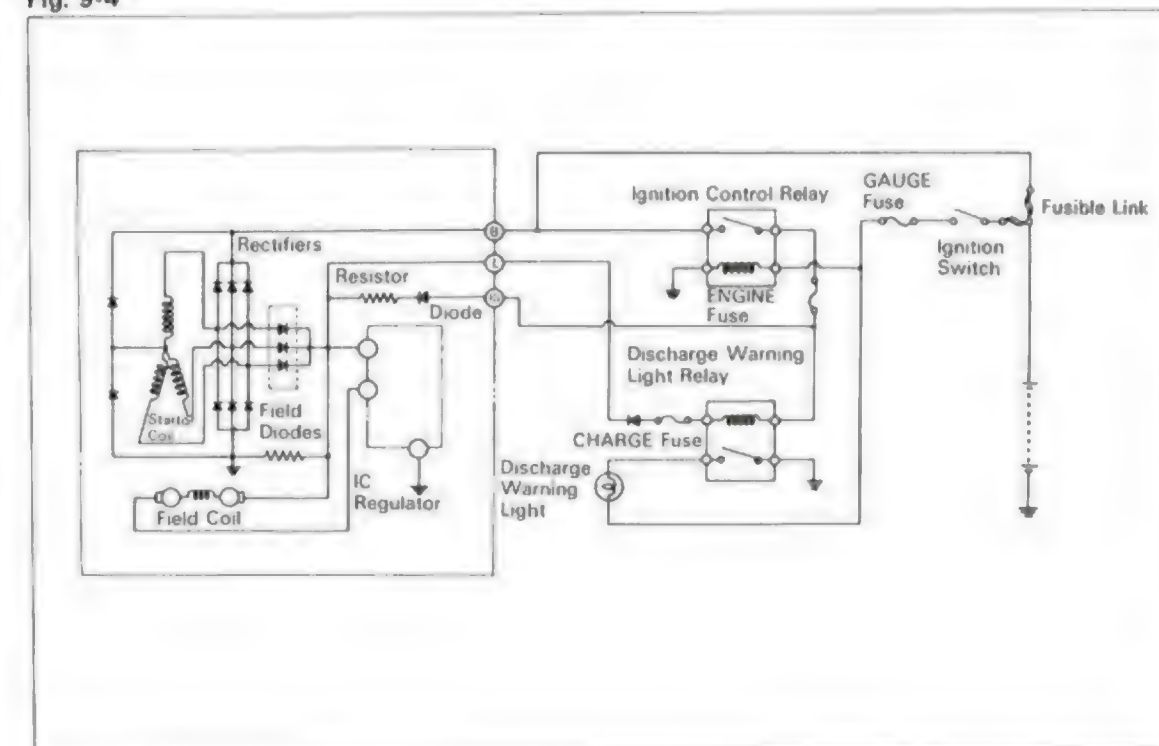


Fig. 9-4



FJ 40, 43, 45 series (IC Regulator Type)

Fig. 9-5

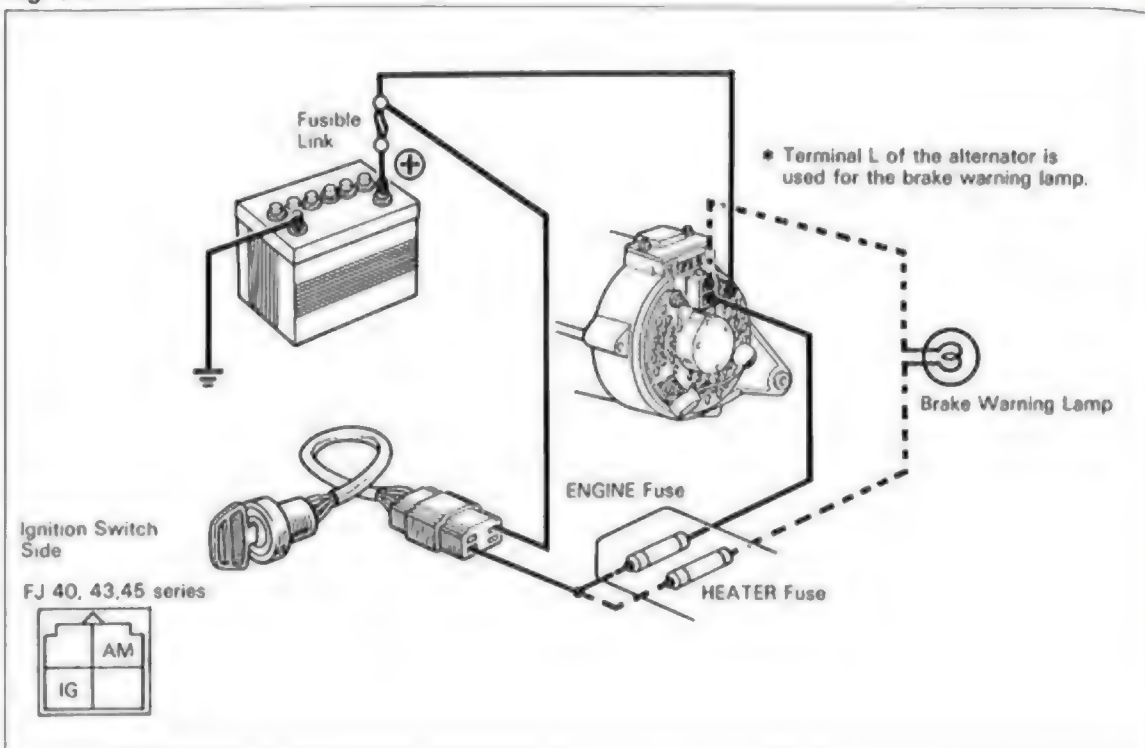
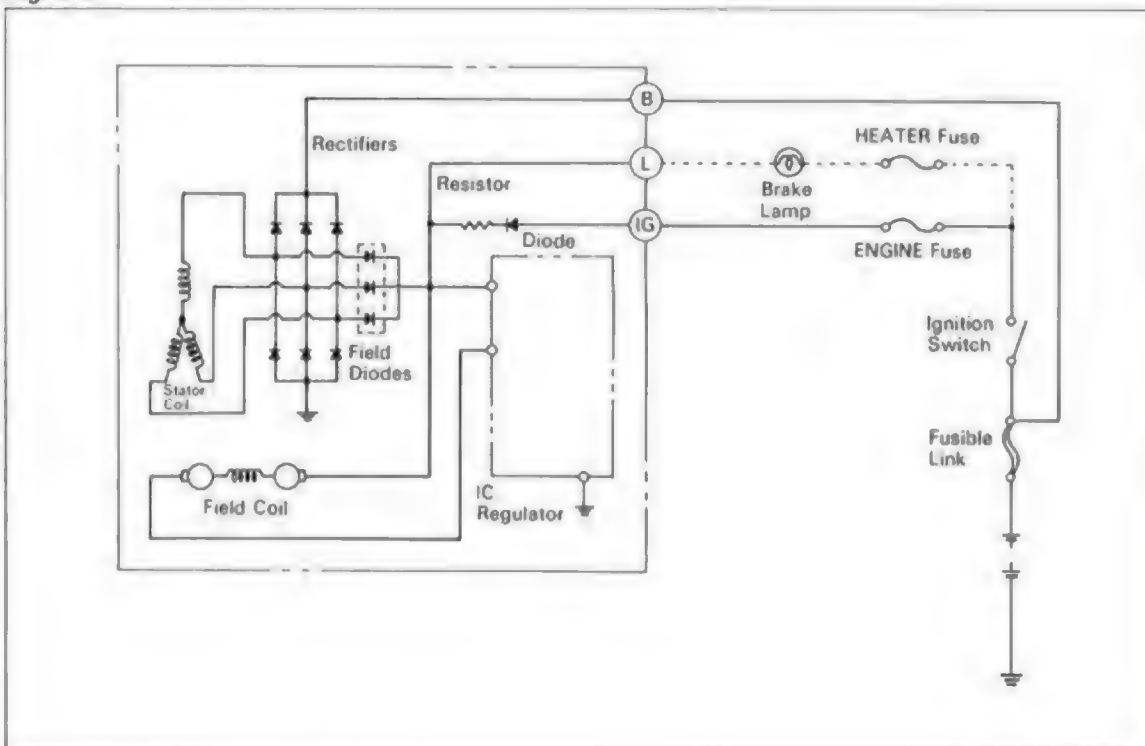


Fig. 9-6



FA series (Tirrill Regulator Type)

Fig. 9-7

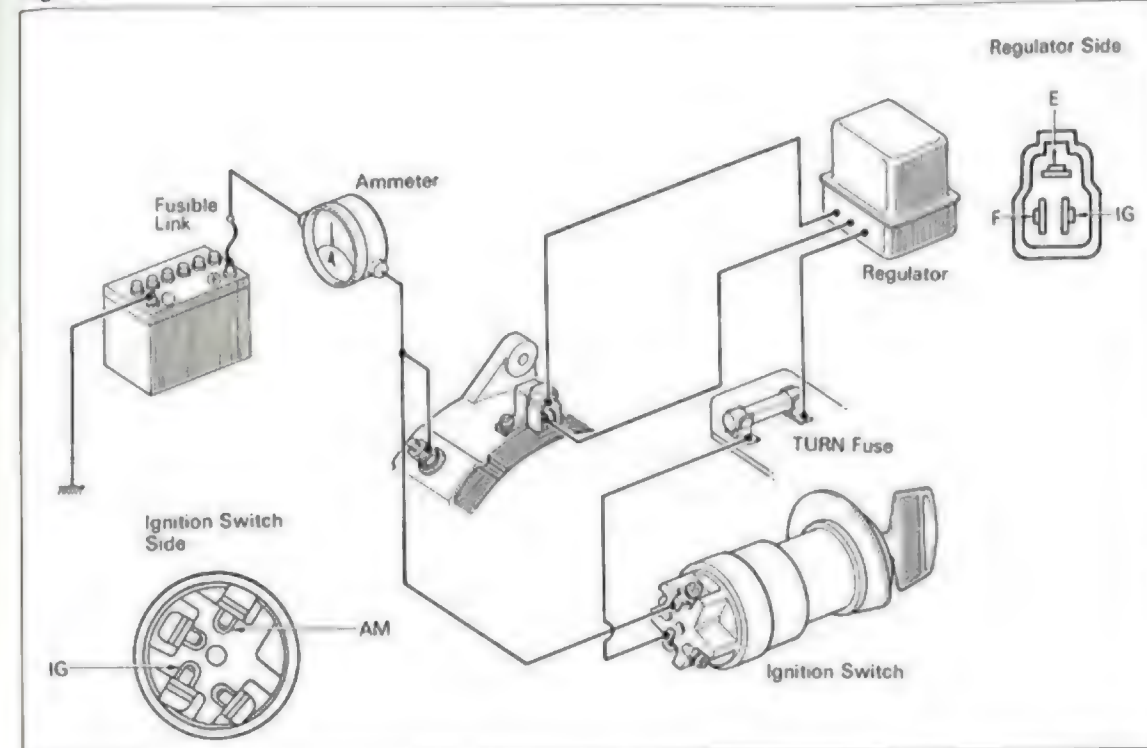


Fig. 9-8

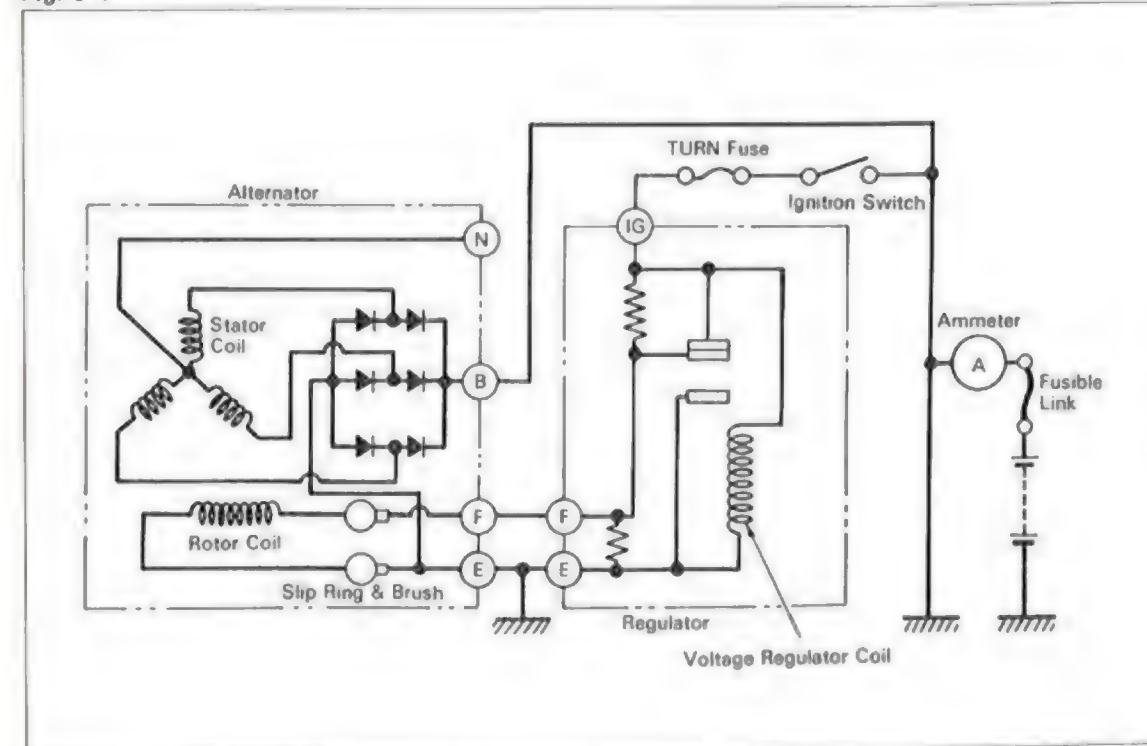


Fig. 9-9

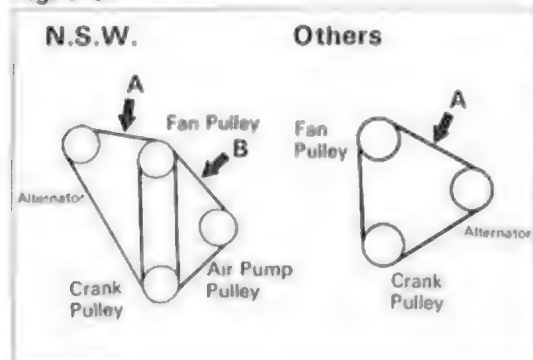


Fig. 9-10

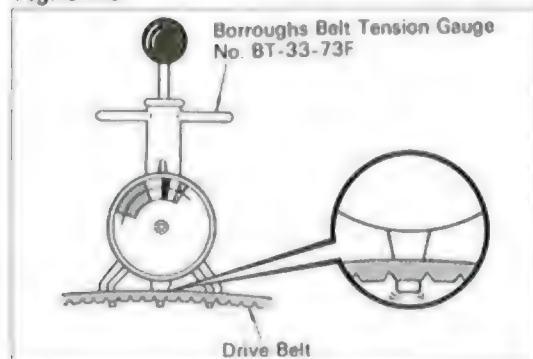


Fig. 9-11

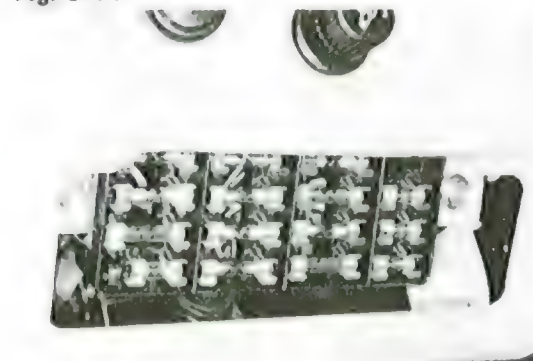


Fig. 9-12



ON-VEHICLE INSPECTION

[Tirril Regulator Type]

CHECK FOLLOWING ITEMS

1. Drive belt tension
(General destinations)
Drive belt deflection (at 10 kg or 22 lb)

	NSW & Victoria	Other Australian states	except Australia
A mm (in.)	13 - 15 (0.51 - 0.59)	7 - 10 (0.28 - 0.39)	New 7 - 9 (0.28 - 0.35) Used 9 - 12 (0.35 - 0.47)
B mm (in.)	7 - 10 (0.28 - 0.39)	—	—

(USA)

Use a borroughs belt tension gauge, No. BT-33-73F.

Drive belt tension:

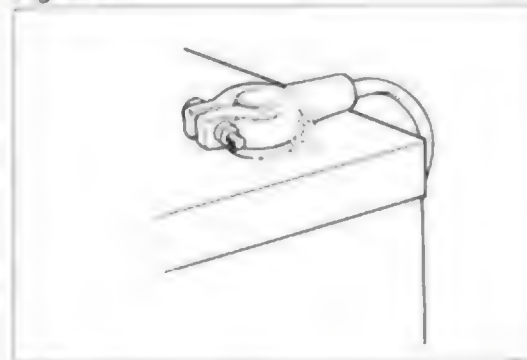
New belt	120 - 170 lbs
Used belt	80 - 120 lbs
w/ Air con.	
New belt	100 - 150 lbs
Used belt	60 - 80 lbs



2. Fuses

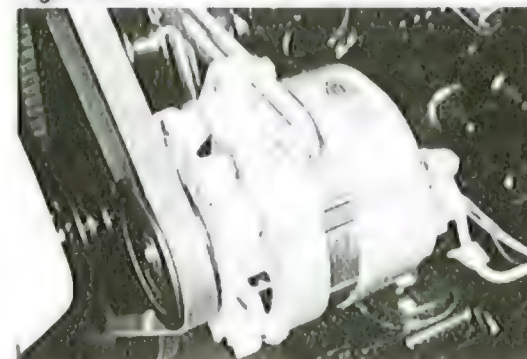
3. Installed condition of wiring for alternator and regulator.

Fig. 9-13



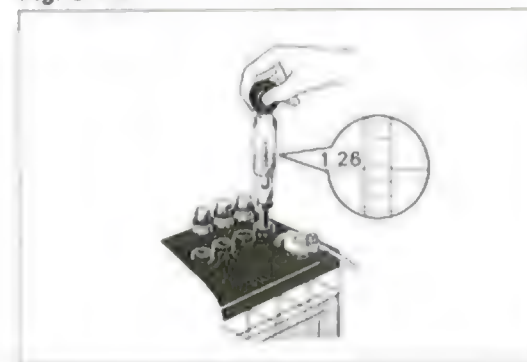
4. Battery terminal and fusible link
Loose
Corroded
Burnt

Fig. 9-14



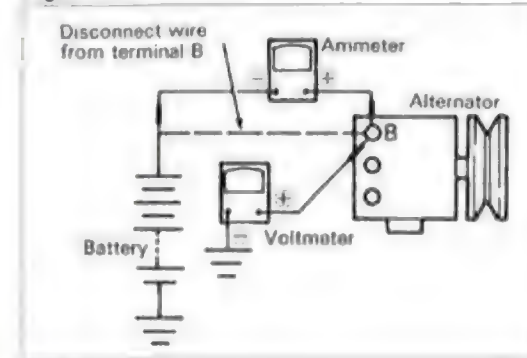
5. Alternator on-vehicle condition
Abnormal noise from the alternator when engine is running

Fig. 9-15



6. Specific gravity
Specific gravity:
[When fully charged at 20°C
(68°F)] 1.25 - 1.27

Fig. 9-16



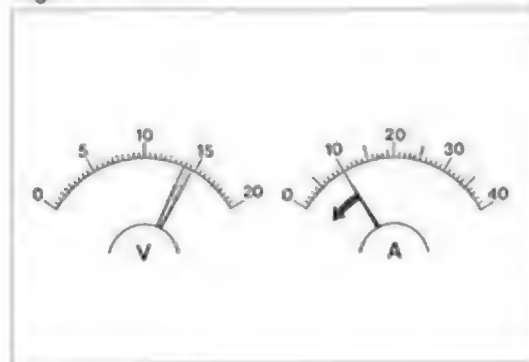
PERFORMANCE TEST WITH VOLTMETER & AMMETER

Connect the voltmeter and ammeter as follows:

- Ammeter ⊕ —→ Alternator terminal B
- Ammeter ⊖ —→ Wire terminal B
- Voltmeter ⊕ —→ Alternator terminal B
- Voltmeter ⊖ —→ Ground

— Note —
Be careful not to cause a short.

Fig. 9-17

**No-load Performance Test**

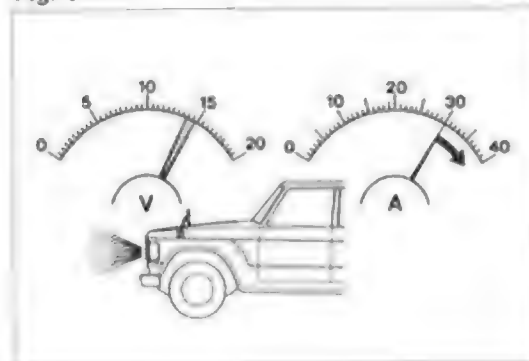
Check the reading on the ammeter and voltmeter.

Current: Less than 10A

Voltage: 13.8 – 14.8 V

Engine speed: Idling to 2,000 rpm

Fig. 9-18

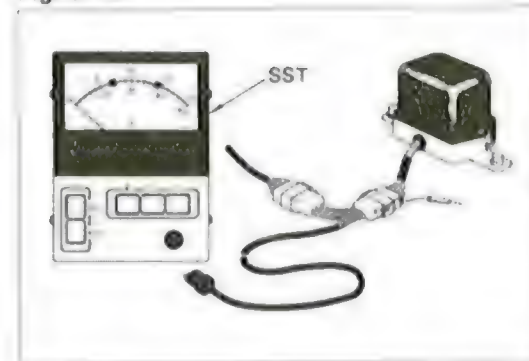
**Load Performance Test**

1. Run engine at 2,000 rpm.
2. Turn on the headlights and all accessories, and check the reading on the ammeter and voltmeter.

Current: More than 30A

Voltage: 13.8 – 14.8 V

Fig. 9-19

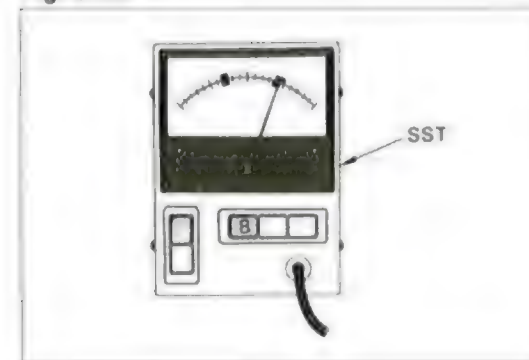
**PERFORMANCE TEST WITH ALTERNATOR CHECKER**

Disconnect the alternator regulator connector and connect SST.

SST [09081-00011]

Push 20 V switch.

Fig. 9-20



1. Check terminal B voltage.

Push switch B.

Raise engine speed from idling to 2,000 rpm

Voltage:

STD 13.8 – 14.8 V

If not within standard, probable cause is the alternator regulator.

Fig. 9-21



2. Check terminal F voltage.

Push switch F.

Raise engine speed from idling to 2,000 rpm

The checker reading should gradually decrease from 12 to 3 volts

If no decrease, probable cause is alternator regulator

Fig. 9-22



3. Check terminal N voltage.

Push switch N.

Maintain engine speed at approximately 1,500 rpm. The pointer should be a half of terminal B voltage.

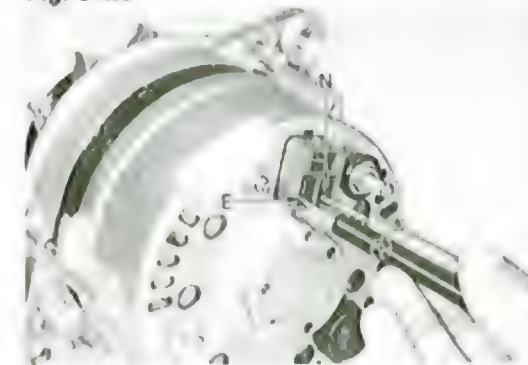
Voltage:

STD 6.9 – 7.4 V

If the voltage is higher, the cause is the \oplus rectifier.

If the voltage is lower, the cause is the \ominus rectifier.

Fig. 9-23

**ALTERNATOR INSPECTION (FJ series)**

1. Negative side rectifier short test.
Connect an ohmmeter \ominus lead to terminal N and \oplus lead to terminal E.
The meter should indicate infinity.

Fig. 9-24



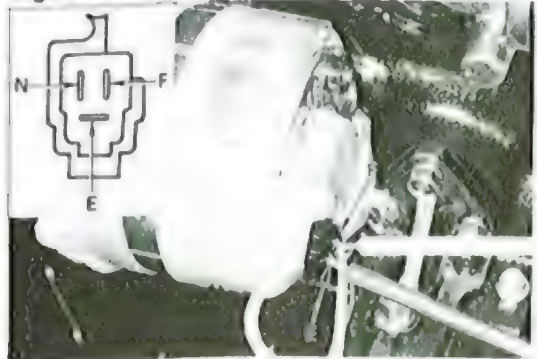
2. Positive side rectifier short test.
Connect an ohmmeter \ominus lead to terminal B and \oplus lead to terminal N.
The meter should indicate infinity.

Fig. 9-25



3. Check the rotor coil resistance.
Resistance: 5 – 9 Ω

Fig. 9-26



4. Turn the starter switch to ON, and check to see if there is battery voltage at terminal F.
If not, check the ENGINE fuse.

Fig. 9-27



ALTERNATOR INSPECTION (FA series)

1. Negative side rectifier short test.
Connect an ohmmeter \ominus lead to terminal N and the \oplus lead to terminal E.
The meter should indicate infinity.

Fig. 9-28



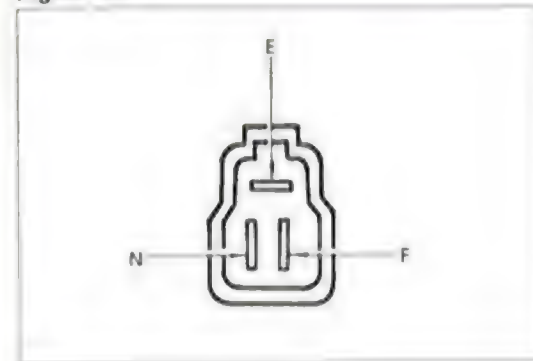
2. Positive side rectifier short test.
Connect an ohmmeter \ominus lead to terminal B and the \oplus lead to terminal N.
The meter should indicate infinity.

Fig. 9-29



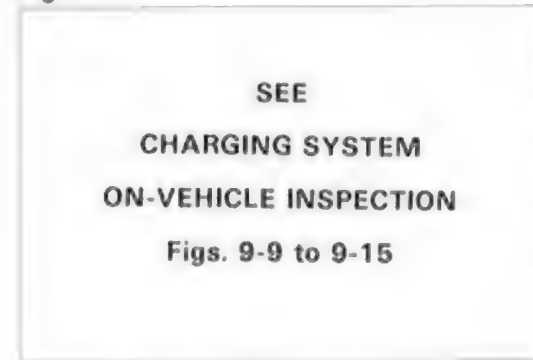
3. Check the rotor coil resistance.
Resistance: 5 – 9 Ω

Fig. 9-30



4. Turn the starter switch to ON, and check to see if there is battery voltage at terminal F referring to Fig. 9-26.
If not, check the ENGINE fuse.

Fig. 9-31

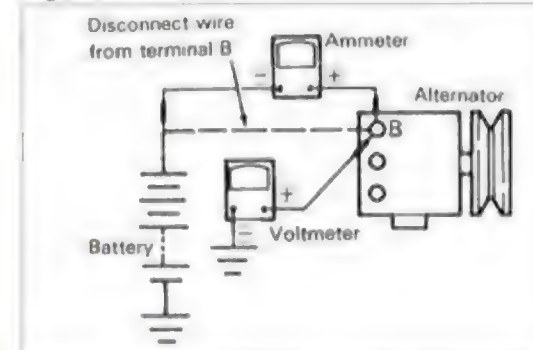


ON-VEHICLE INSPECTION [IC Regulator Type]

CHECK FOLLOWING ITEMS

1. Drive belt tension.
2. Fuses.
3. Installed condition of wiring for alternator and regulator.
4. Battery terminal and fusible link.
5. Alternator on-vehicle condition.
6. Specific gravity.

Fig. 9-32



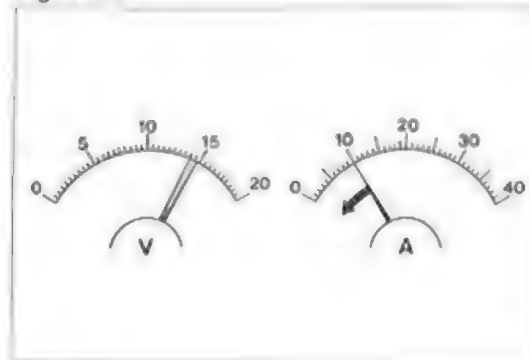
PERFORMANCE TEST

Connect the voltmeter and ammeter as follows:

- | | | |
|---------------------|---|-----------------------|
| Ammeter \oplus | → | Alternator terminal B |
| Ammeter \ominus | → | Wire terminal B |
| Voltmeter \oplus | → | Alternator terminal B |
| Voltmeter \ominus | → | Ground |

— Note —
Be careful not to cause a short.

Fig. 9-33

**No-load Performance Test**

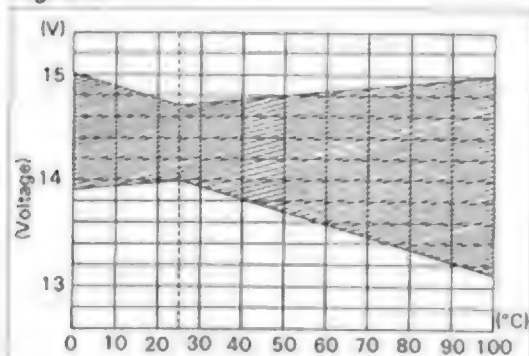
Check the reading on the ammeter and voltmeter.

Current: Less than 10A

Voltage: 14.0 – 14.7 V
(25°C or 77°F)

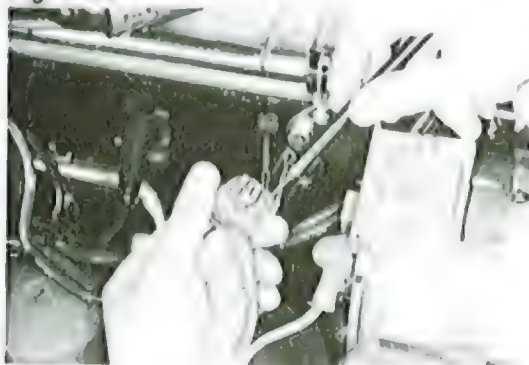
Engine speed: 2,000 rpm

Fig. 9-34

**— Note —**

If the temperature is not 25°C (77°F), find the voltage limits in the chart for the correct temperature.

Fig. 9-35

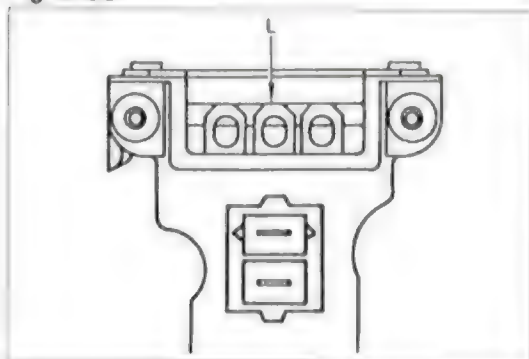


If the voltage reading is less than 13.5 V, check the alternator and IC regulator as follows.

1. Turn the starter switch to ON and check the voltage reading at the alternator IG terminal.

If no voltage, check the engine fuse and/or starter switch

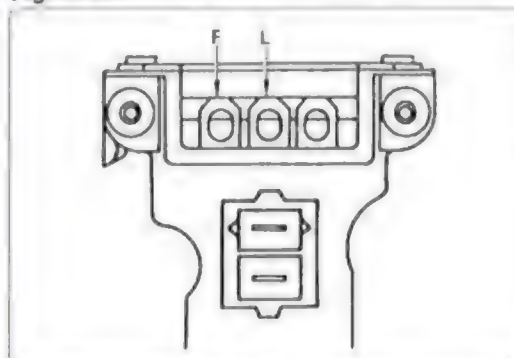
Fig. 9-36



2. Remove the end cover from the IC regulator and check the voltage reading at the regulator terminal L.

If the voltage reading is zero to 2 volts, check the alternator

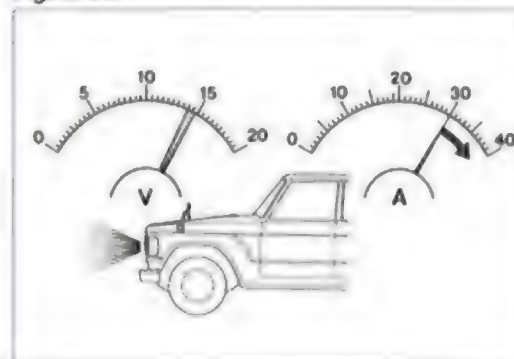
Fig. 9-37



If the voltage reading is the same as battery voltage, turn the starter switch to OFF and check that there is continuity between the alternator terminals L and F.

No continuity — Check the alternator.
Continuity — Replace the IC regulator

Fig. 9-38

**Load Performance Test**

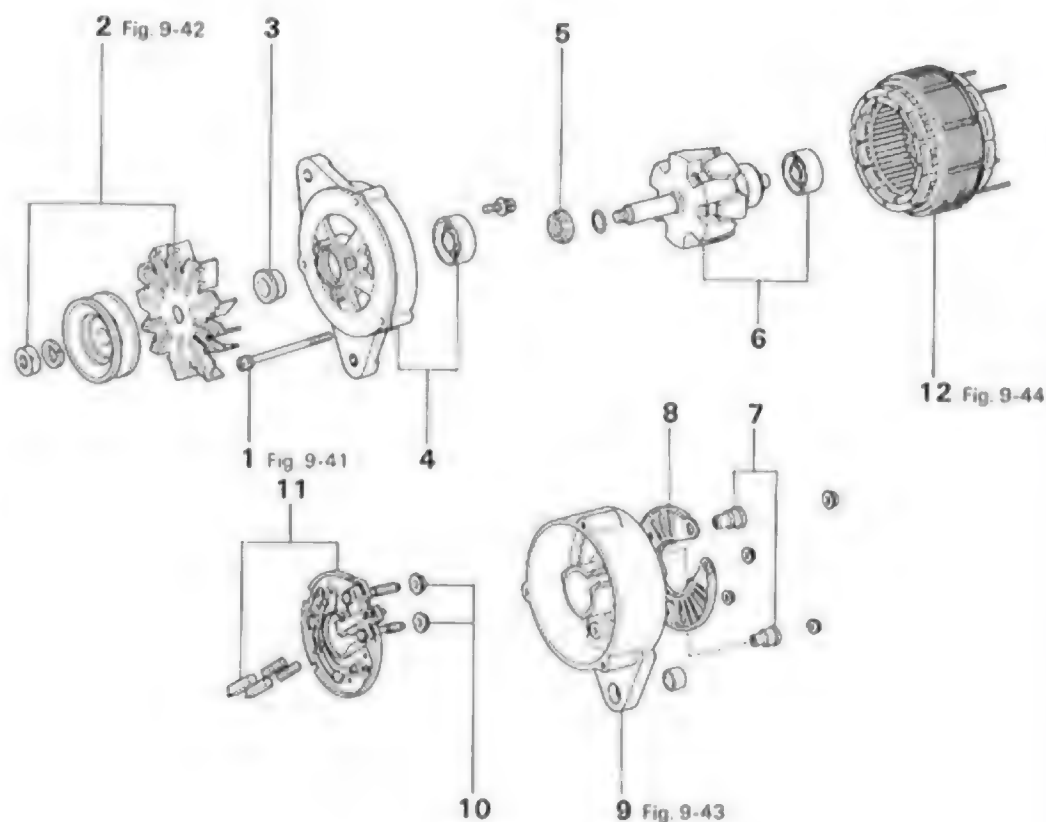
1. Run the engine at 2,000 rpm.
2. Turn on the headlights and all accessories. Then check the reading on the ammeter and voltmeter.

Current: More than 30 A

Voltage: 14.0 – 14.7 V

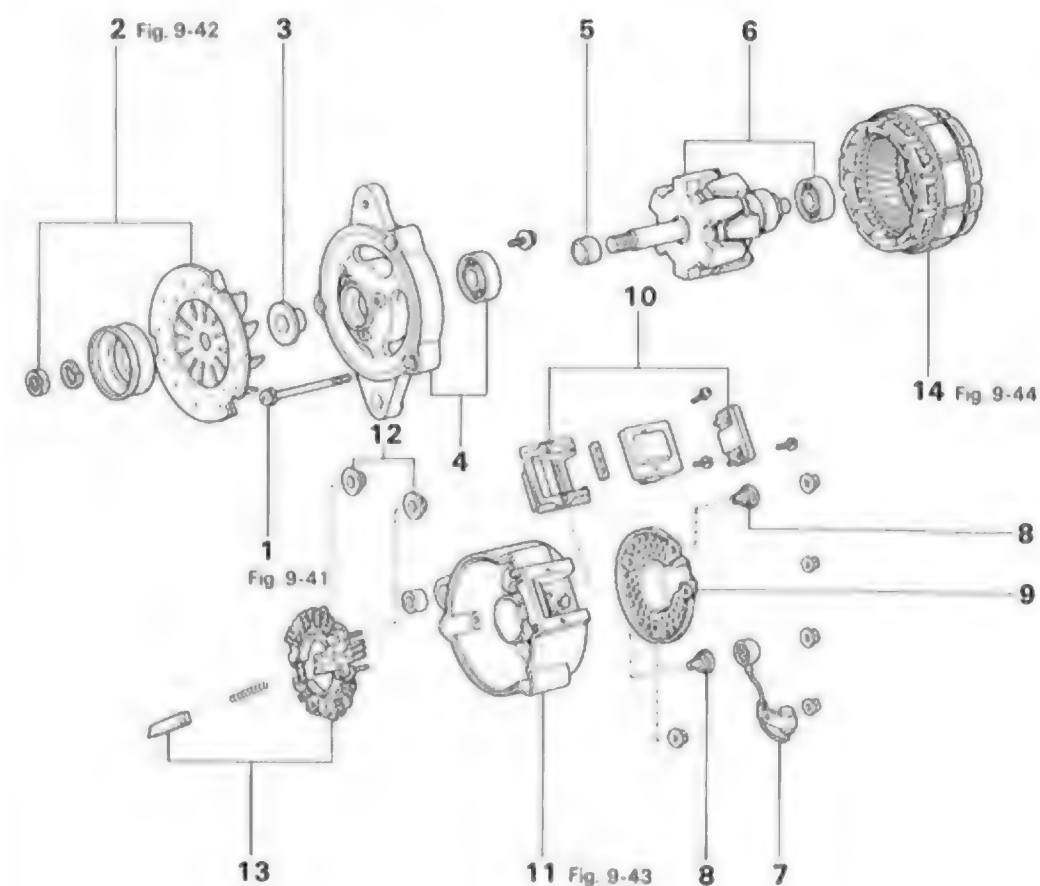
ALTERNATOR (FJ series)**DISASSEMBLY**

Disassemble the parts in the numerical order shown in the figure.

Fig. 9-39**FJ series (Tirril Regulator Type)**

- | | |
|------------------------------------|-------------------------------------|
| 1. Through Bolt | 7. Insulator |
| 2. Pulley & Fan | 8. Rear End Cover (except USA) |
| 3. Space Collar | 9. Rear End Frame |
| 4. Drive End Frame & Front Bearing | 10. Insulator |
| 5. Ring | 11. Brush Holder & Rectifier Holder |
| 6. Rotor & Rear Bearing | 12. Stator Coil |

Disassemble the parts in the numerical order shown in the figure.

Fig. 9-40**FJ series (IC Regulator Type)**

- | | |
|------------------------------------|-------------------------------------|
| 1. Through Bolt | 8. Insulator |
| 2. Pulley & Fan | 9. Rear End Cover |
| 3. Space Collar | 10. IC Regulator |
| 4. Drive End Frame & Front Bearing | 11. Rear End Frame |
| 5. Ring | 12. Insulator |
| 6. Rotor & Rear Bearing | 13. Brush Holder & Rectifier Holder |
| 7. Noise Suppression Condenser | 14. Stator Coil |

Fig. 9-41



Pry off the drive end frame from the stator.

— Note —

Be careful not to damage the coil wires.

Fig. 9-42



Clamp the rotor in a soft jaw vise and loosen the pulley nut.

Fig. 9-43

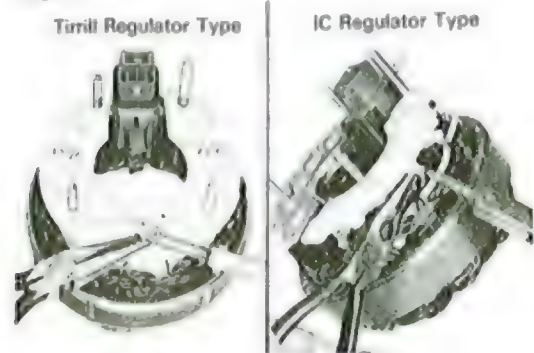


Remove the rear end frame from the stator and rectifier holder.

— Note —

For IC regulator type, remove the regulator before separating the rear end frame.

Fig. 9-44



Disconnect the stator coil from the rectifier holder by melting the solder.

— Note —

When unsoldering the leads, hold the rectifier lead with a long nose pliers to protect the rectifier from heat.

Fig. 9-45

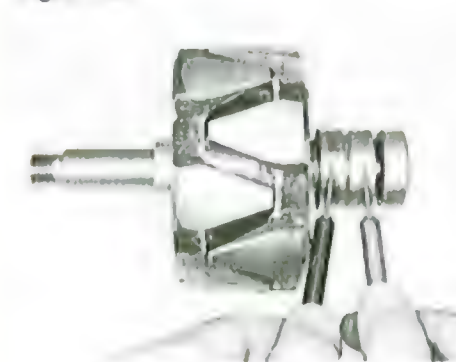


INSPECTION

Rotor

1. Check the slip rings for dirt or burns.

Fig. 9-46



2. Open circuit test
Check for continuity between both slip rings

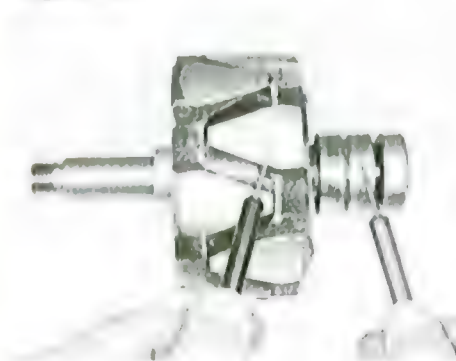
If there is no continuity, replace the rotor

Resistance:

Tirrell regulator type
3.9 – 4.1 Ω

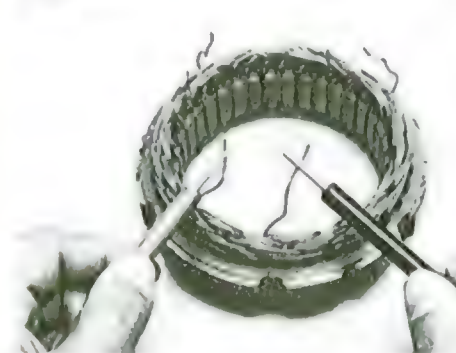
IC regulator type
2.8 – 3.0 Ω

Fig. 9-47



3. Ground test
Check that there is no continuity between the slip ring and rotor.
If there is continuity, replace the rotor.

Fig. 9-48



Stator (Tirrell regulator type)

1. Open circuit test
Check that there is continuity between the two leads near each other
If there is no continuity, replace the stator

Fig. 9-49



- 2 Ground test
Check that there is no continuity between the coil leads and stator core.
If there is continuity, replace the stator.

Fig. 9-50



Stator (IC regulator type)

- 1 Open circuit test
Check that there is continuity between the three-wire junction and the other leads.
If there is no continuity, replace the stator.

— Note —

Check for continuity when the junction wires are connected with solder.

Fig. 9-51



- 2 Ground test
Check that there is no continuity between the coil leads and stator core.
If there is continuity, replace the stator.

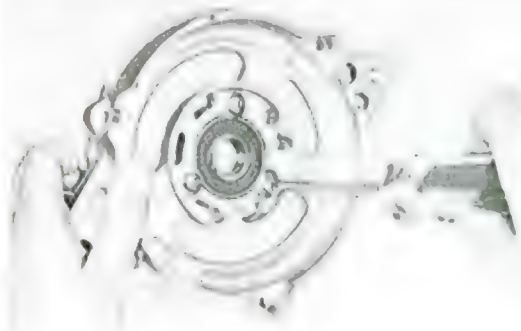
Fig. 9-52



Bearings

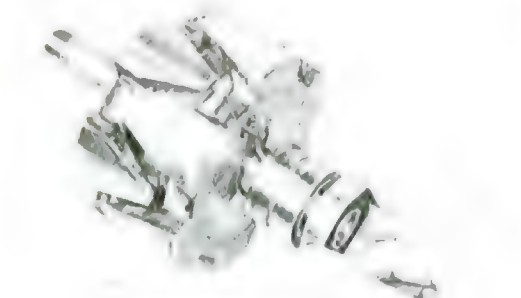
- 1 Check the front bearing for wear or roughness

Fig. 9-53



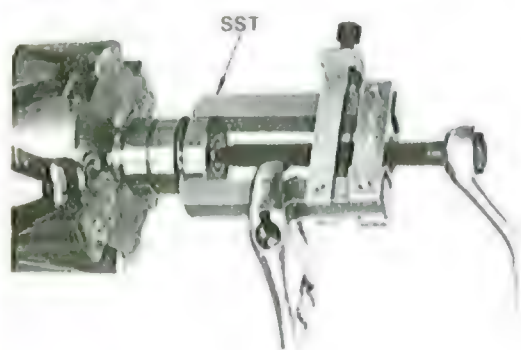
2. Replace the front bearing with new one if necessary

Fig. 9-54



3. Check the rear bearing for wear or roughness

Fig. 9-55



- 4 Replace the rear bearing if necessary.
(1) Remove the rear bearing with SST.
SST [09286-46011]

Fig. 9-56

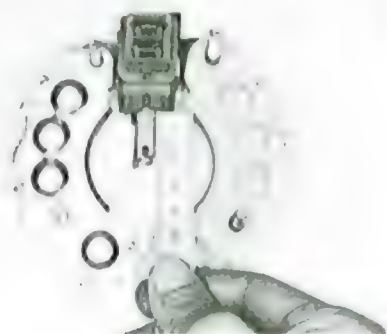


- (2) Press a new bearing onto the rotor shaft

— Note —

Be careful not to press it in slantwise.

Fig. 9-57

**Brush & Brush Holder**

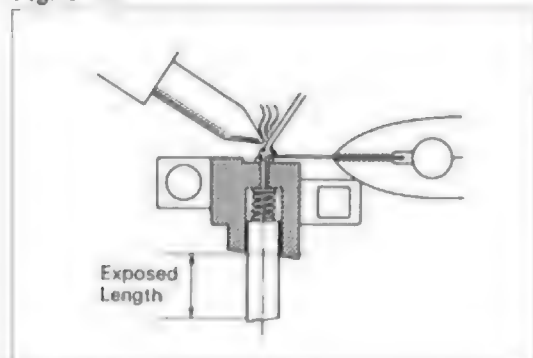
1. Measure the exposed brush length

Exposed length:

Minimum 5.5 mm
(0.217 in.)

If the brush length is less than minimum,
replace the brush.

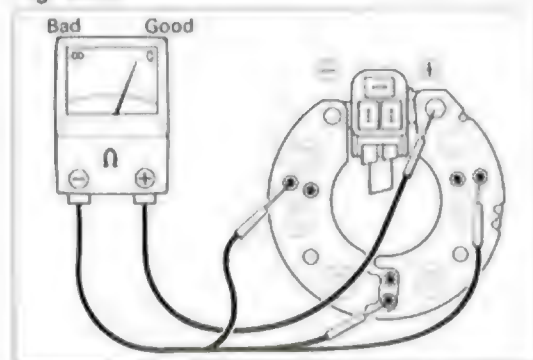
Fig. 9-58



2. When replacing the brushes, assemble them as shown in the figure.

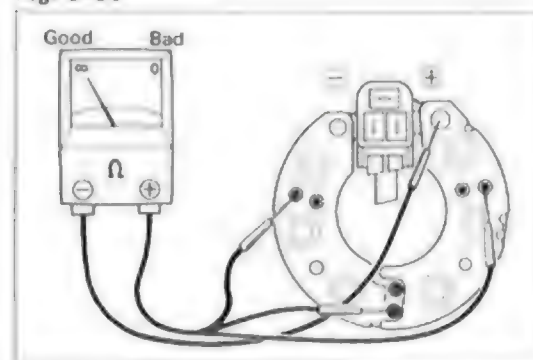
Exposed length: 12.5 mm
(0.492 in.)

Fig. 9-59

**Rectifier****(Tirill regulator type — 40,45A)**

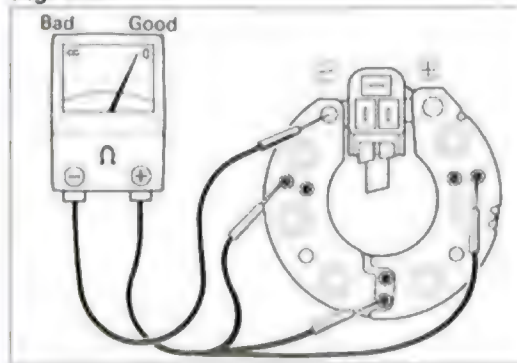
1. Rectifier holder positive side
Connect an ohmmeter \oplus lead to the rectifier holder, and the \ominus lead of the meter to each rectifier terminal. If there is no continuity, the rectifier assembly must be replaced.

Fig. 9-60



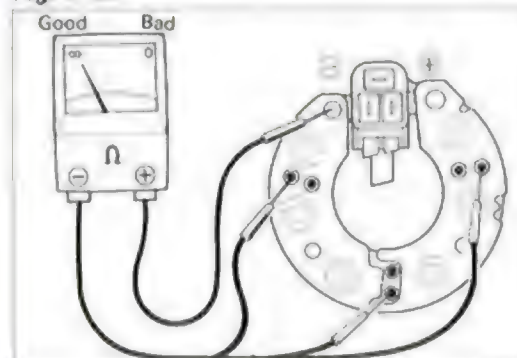
2. Reverse polarity of the test leads and check again. If there is continuity, the rectifier assembly must be replaced.

Fig. 9-61



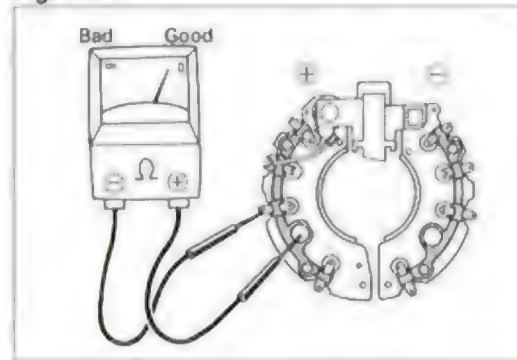
3. Rectifier holder negative side
Connect an ohmmeter \oplus lead to each rectifier terminal, and the \ominus lead of the meter to the rectifier holder. If there is no continuity, the rectifier assembly must be replaced.

Fig. 9-62



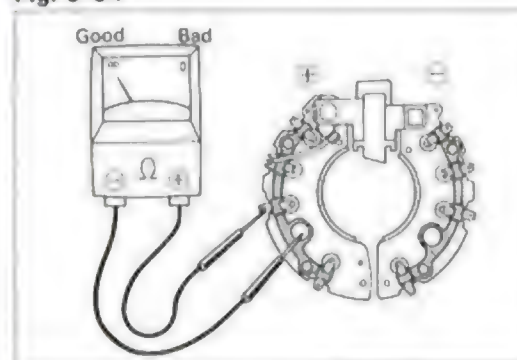
4. Reverse polarity of the test leads and check again. If there is continuity, the rectifier assembly must be replaced.

Fig. 9-63

**Rectifier (Tirill Regulator Type — 50A)**

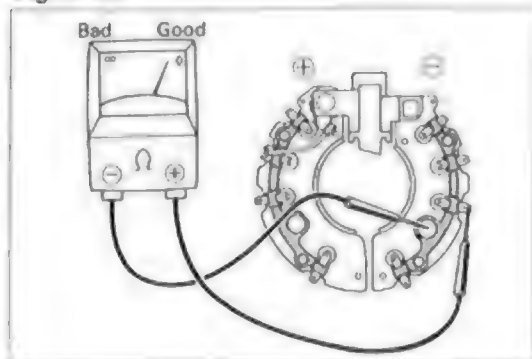
1. Rectifier holder positive side
Connect an ohmmeter \oplus lead to the rectifier holder, and the \ominus lead of the meter to the rectifier terminal. If there is no continuity, the rectifier assembly must be replaced.

Fig. 9-64



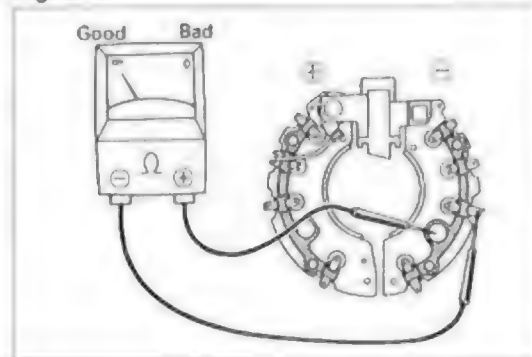
2. Reverse polarity of the test leads and check again. If there is continuity, the rectifier assembly must be replaced.

Fig. 9-65



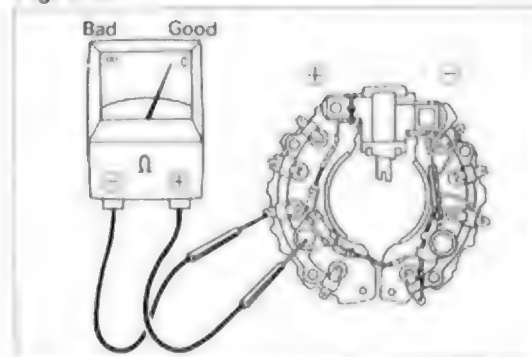
- 3 Rectifier holder negative side
Connect an ohmmeter \oplus lead to the rectifier terminal, and the \ominus lead of the meter to the rectifier holder. If there is no continuity, the rectifier assembly must be replaced.

Fig. 9-66



- 4 Reverse polarity of the test leads and check again. If there is continuity, the rectifier assembly must be replaced.

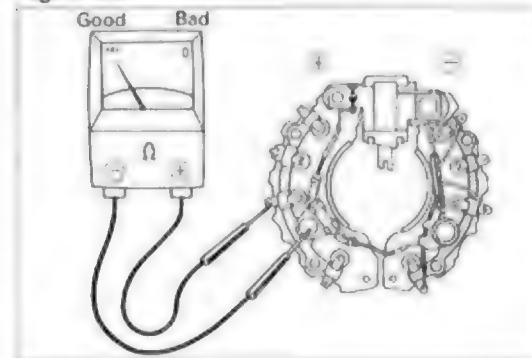
Fig. 9-67



Rectifier (IC regulator type)

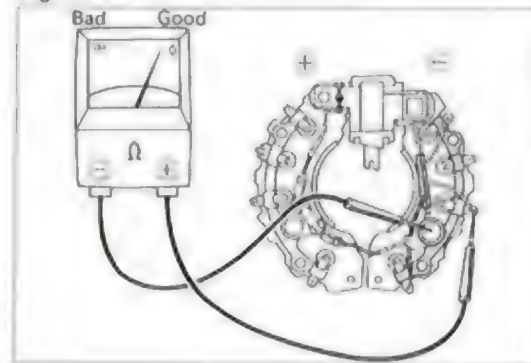
- 1 Rectifier holder positive side
Connect an ohmmeter \oplus lead to the rectifier holder, and the \ominus lead of the meter to the rectifier terminal. If there is no continuity, the rectifier assembly must be replaced.

Fig. 9-68



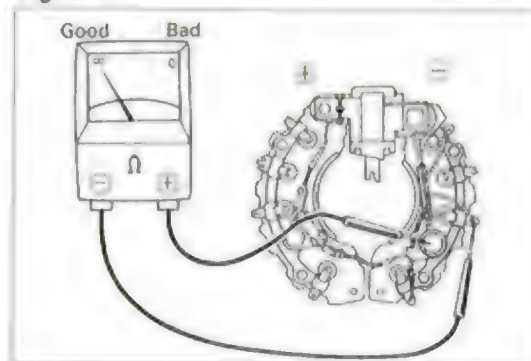
- 2 Reverse polarity of the test leads and check again. If there is continuity, the rectifier assembly must be replaced.

Fig. 9-69



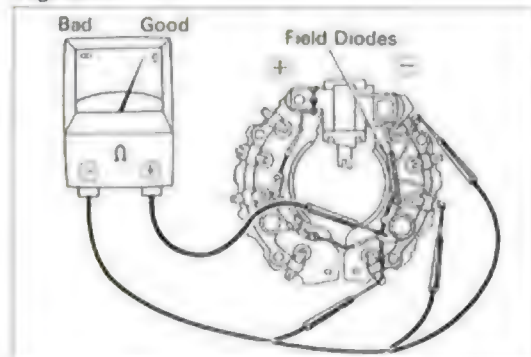
- 3 Rectifier holder negative side
Connect an ohmmeter \oplus lead to the rectifier terminal, and the \ominus lead of the meter to the rectifier holder. If there is no continuity, the rectifier assembly must be replaced.

Fig. 9-70



- 4 Reverse polarity of the test leads and check again. If there is continuity, the rectifier assembly must be replaced.

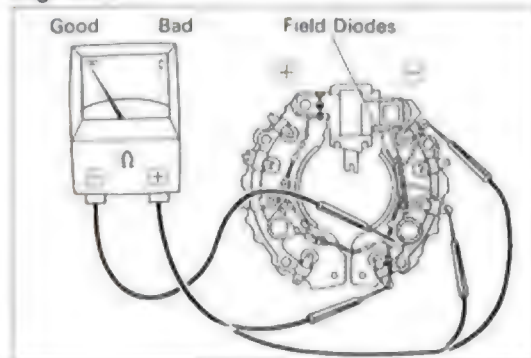
Fig. 9-71



Field Diodes (IC regulator type)

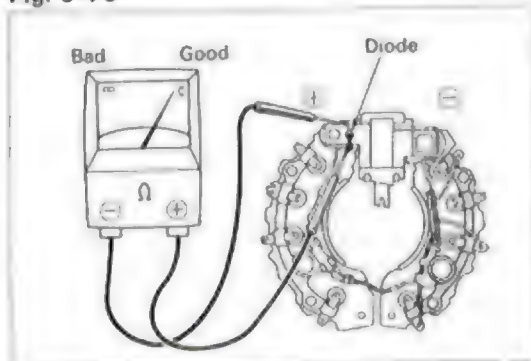
- 1 Connect an ohmmeter \oplus lead to the rectifier holder, and the \ominus lead of the meter to the field diode terminal. If there is no continuity, the rectifier assembly must be replaced.

Fig. 9-72



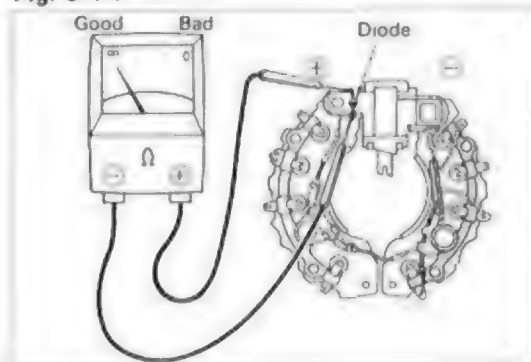
- 2 Reverse polarity of the test leads and check again. If there is continuity, the rectifier assembly must be replaced.

Fig. 9-73

**Diode (IC regulator type)**

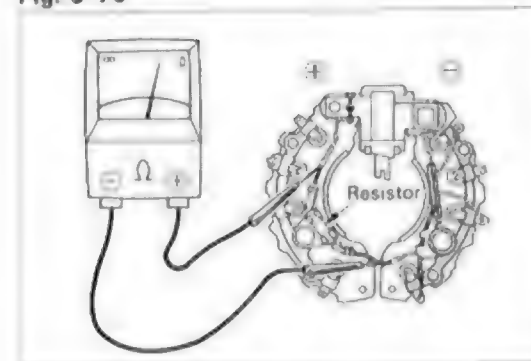
1. Connect an ohmmeter \oplus lead to the resistor side, and the \ominus lead of the meter to the diode other side. If there is no continuity, the rectifier assembly must be replaced.

Fig. 9-74



2. Reverse polarity of the test leads and check again. If there is continuity, the rectifier assembly must be replaced.

Fig. 9-75

**Resistor (IC regulator type)**

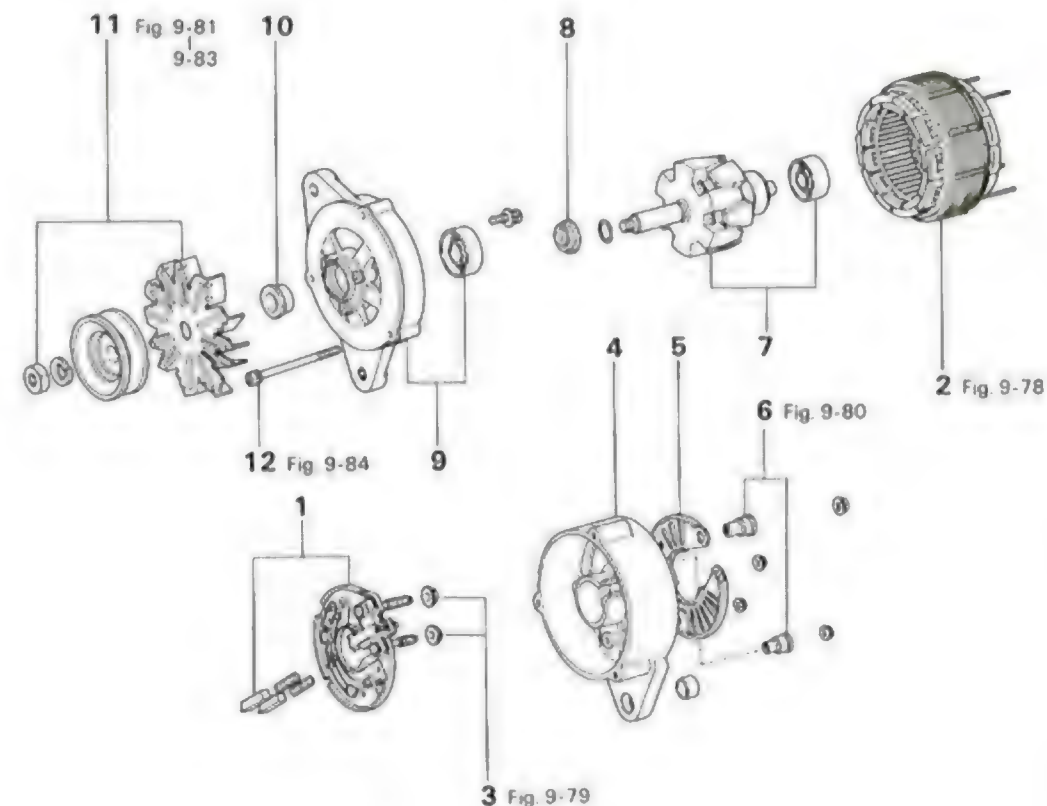
Measure the resistance of the resistor with an ohmmeter

Resistance: 19Ω

ASSEMBLY

Assemble the parts in the numerical order shown in the figure.

Fig. 9-76

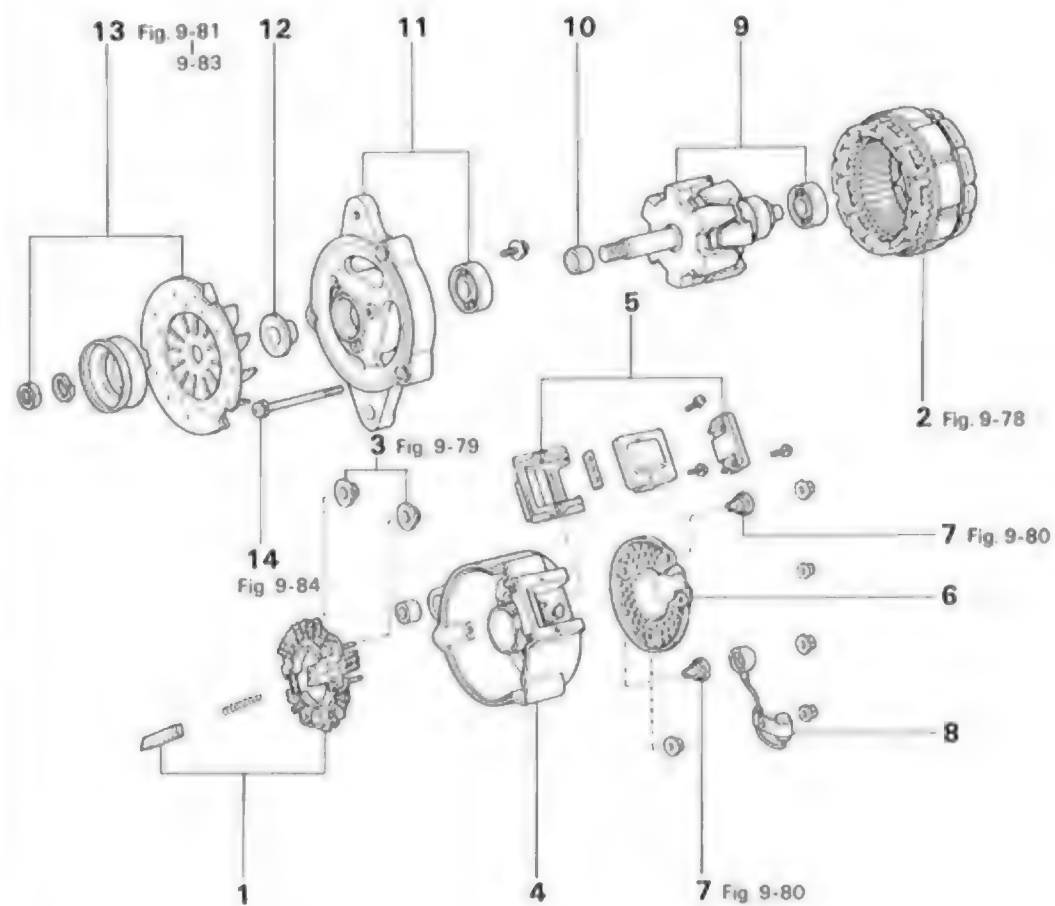
FJ series (Tirrell Regulator Type)

- | | |
|------------------------------------|------------------------------------|
| 1. Brush Holder & Rectifier Holder | 7. Rotor & Rear Bearing |
| 2. Stator Coil | 8. Ring |
| 3. Insulator | 9. Drive End Frame & Front Bearing |
| 4. Rear End Frame | 10. Spacer Collar |
| 5. Rear End Cover (except USA) | 11. Pulley & Fan |
| 6. Insulator | 12. Through Bolt |

Assemble the parts in the numerical order shown in the figure.

Fig. 9-77

FJ series (IC Regulator Type)

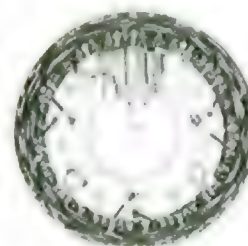


- | | |
|------------------------------------|-------------------------------------|
| 1. Brush Holder & Rectifier Holder | 8. Noise Suppression Condenser |
| 2. Stator Coil | 9. Rotor & Rear Bearing |
| 3. Insulator | 10. Ring |
| 4. Rear End Frame | 11. Drive End Frame & Front Bearing |
| 5. IC Regulator | 12. Space Collar |
| 6. Rear End Cover | 13. Pulley & Fan |
| 7. Insulator | 14. Through Bolt |

Fig. 9-78

Torrill Regulator Type

IC Regulator Type



Solder each stator lead to the rectifier as shown in the figure.

— Note —
Protect the rectifier from heat.

Fig. 9-79



Assemble the rectifier holder with the insulators.

Fig. 9-80



Assemble the rear end cover with the insulators.

Fig. 9-81



Clamp the rotor with a soft jaw vise and tighten the pulley nut.

Tightening torque: 5.0 – 6.5 kg-m
(37 – 47 ft-lb)

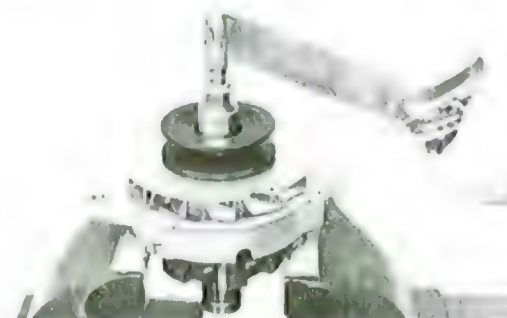
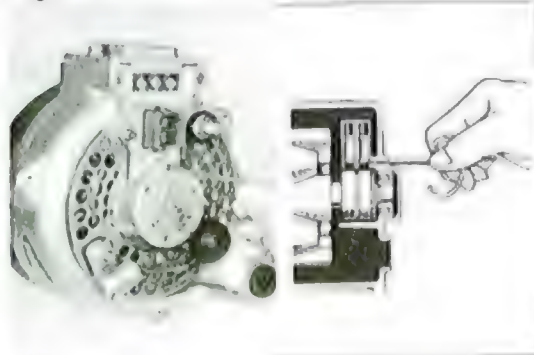
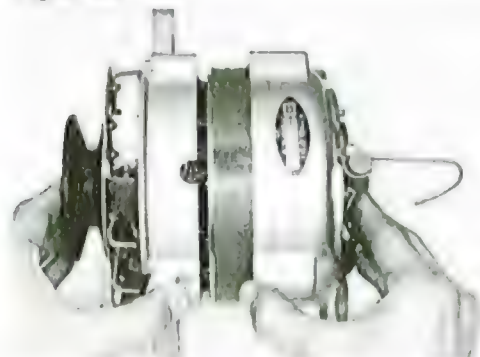


Fig. 9-82



Push in the brushes and temporarily lock them in place with wire inserted through the access hole in the rear end frame.

Fig. 9-83



Assemble the drive end frame and the rectifier end frame by inserting the rear bearing into the rear end frame. Then, remove the wire from the access hole.

Fig. 9-84



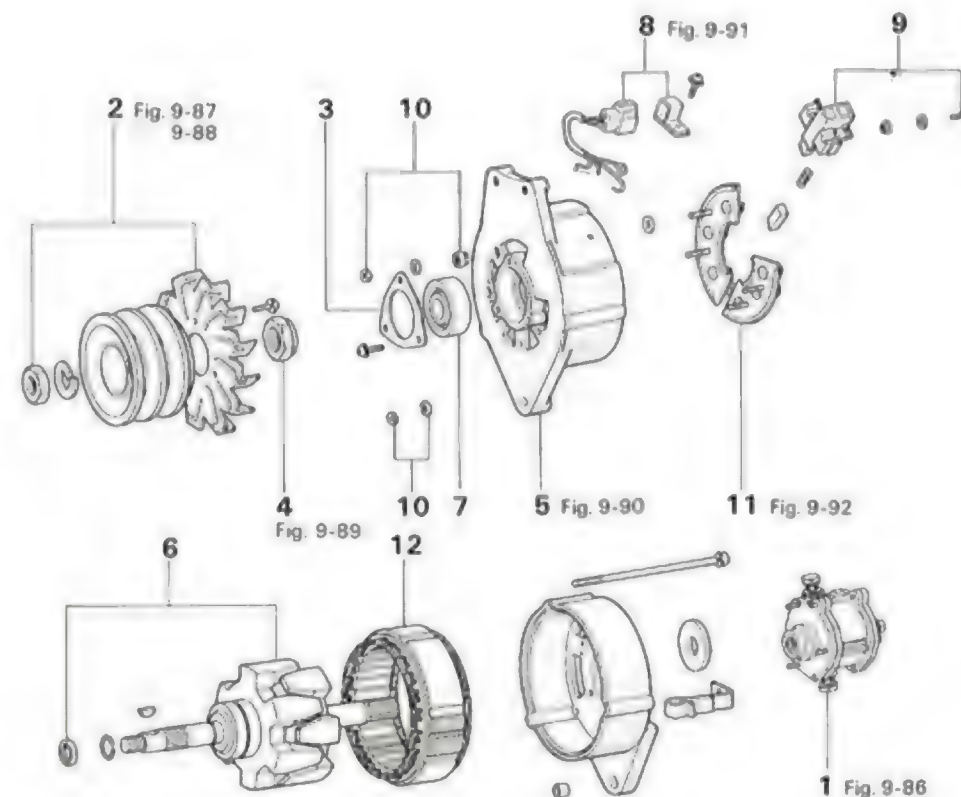
Check the rotor for smooth rotation after assembly.

ALTERNATOR (FA series)

DISASSEMBLY

Disassemble the parts in the numerical order shown in the figure.

Fig. 9-85



1. Vacuum Pump
2. Pulley & Fan
3. Plate
4. Lock Nut
5. Drive End Frame
6. Rotor

7. Bearing
8. Terminal
9. Brush Holder
10. Insulator & Nut
11. Rectifier Holder & Insulator
12. Stator Coil

Fig. 9-86



Lightly tap the vacuum pump with a plastic hammer to remove the pump.

Fig. 9-87

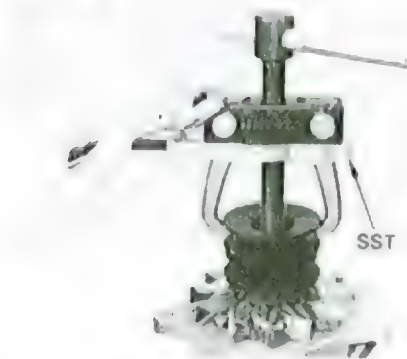


Secure the rotor shaft in a soft jaw vise and then loosen the pulley nut.

— Note —

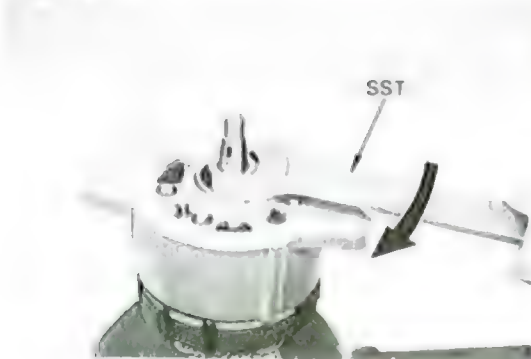
Be careful not to damage the stator coil.

Fig. 9-88



Using SST, remove the pulley with the fan. SST [09950-20014]

Fig. 9-89



Remove the bearing lock nut with SST. SST [09333-55011]

— Note —

The bearing lock nut has left-hand threads.

Fig. 9-90

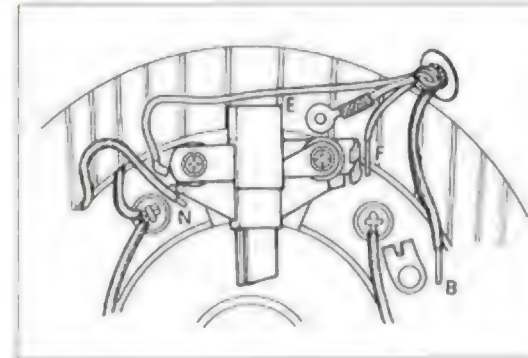


Using SST, remove the drive end frame together with the stator coil from the rotor. SST [09950-20014]

— Note —

Be careful not to damage the stator coil.

Fig. 9-91



Disconnect E, N, F, and B leads by melting the solder, and remove the stator coil with rectifier holders.

Fig. 9-92

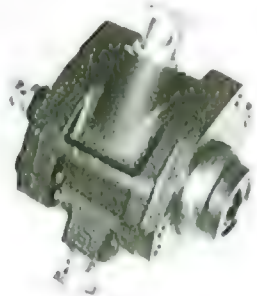


Disconnect the stator coil from the rectifier holder by melting the solder.

— Note —

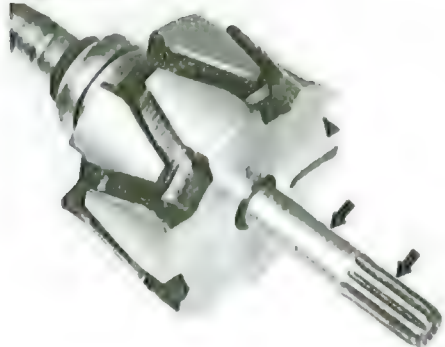
When unsoldering the leads, hold the rectifier lead with a long nose pliers to protect the rectifier from heat.

Fig. 9-93

**INSPECTION & REPAIR****Vacuum Pump**

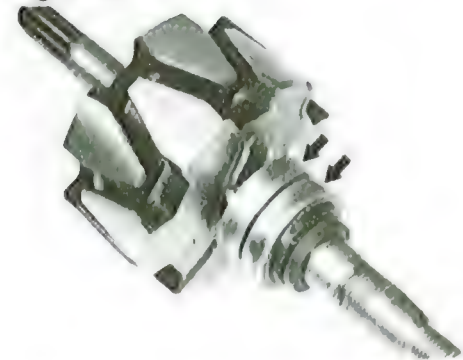
1. Check the oil seal and bushing for wear or damage.

Fig. 9-94



2. Check the bushing journal and spline teeth for wear.

Fig. 9-95

**Rotor**

1. Check the slip ring for dirt or burns.

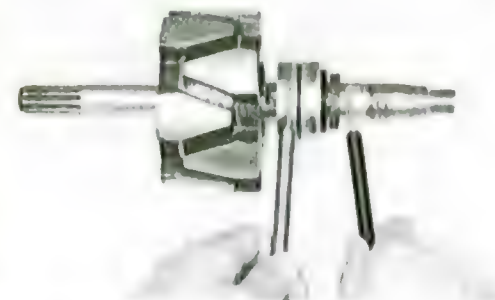
Fig. 9-96



2. Open circuit test
Measure the resistance between both slip rings

Resistance:
STD 19.0 Ω

Fig. 9-97



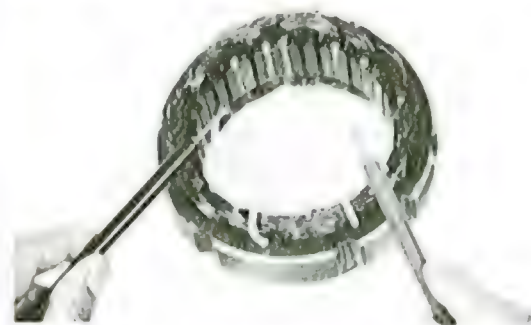
3. Ground test
Check that there is no continuity between the slip ring and rotor

Fig. 9-98

**Bearing**

- Check the bearing for wear or roughness

Fig. 9-99

**Stator**

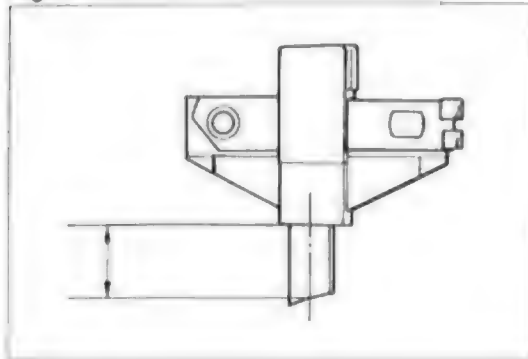
1. Open circuit test
Check that there is continuity between each coil lead.

Fig. 9-100



2. Ground test
Check that there is no continuity between each coil lead and stator core

Fig. 9-101

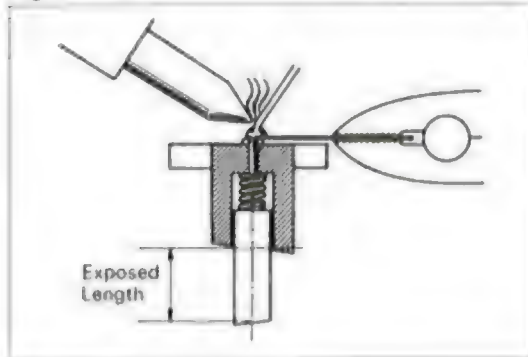
**Brush & Brush Holder**

1. Measure the exposed brush length.

Exposed length:

Minimum 5.5 mm
(0.217 in.)

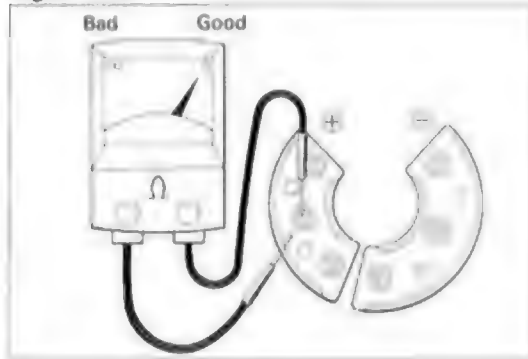
Fig. 9-102



2. When replacing the brushes, assemble them as shown in the figure.

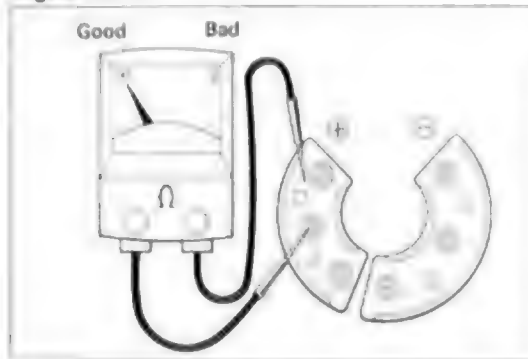
Exposed length: 12.5 mm
(0.492 in.)

Fig. 9-103

**Rectifier**

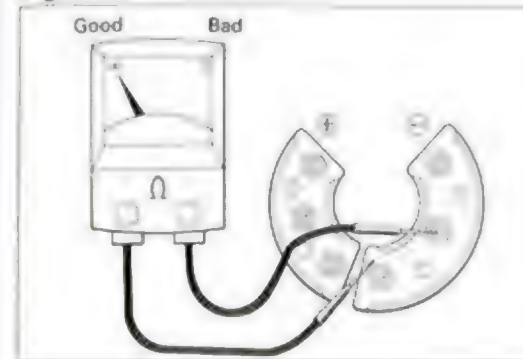
1. Rectifier holder positive side
Connect an ohmmeter \oplus lead to the rectifier holder, and the \ominus lead to the rectifier terminal.
If there is no continuity, the rectifier assembly must be replaced.

Fig. 9-104



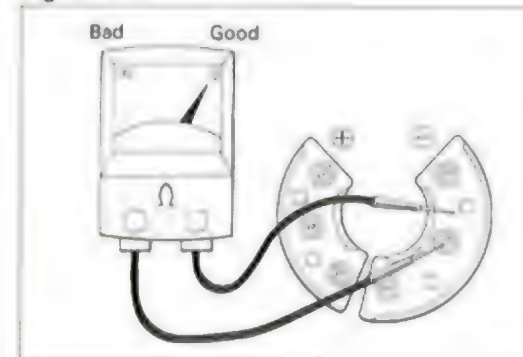
2. Reverse polarity of the test leads and check again.
If there is continuity, the rectifier assembly must be replaced.

Fig. 9-105



3. Rectifier holder negative side
Connect an ohmmeter \oplus lead to the rectifier terminal, and the \ominus lead to the rectifier holder.
If there is no continuity, the rectifier assembly must be replaced.

Fig. 9-106

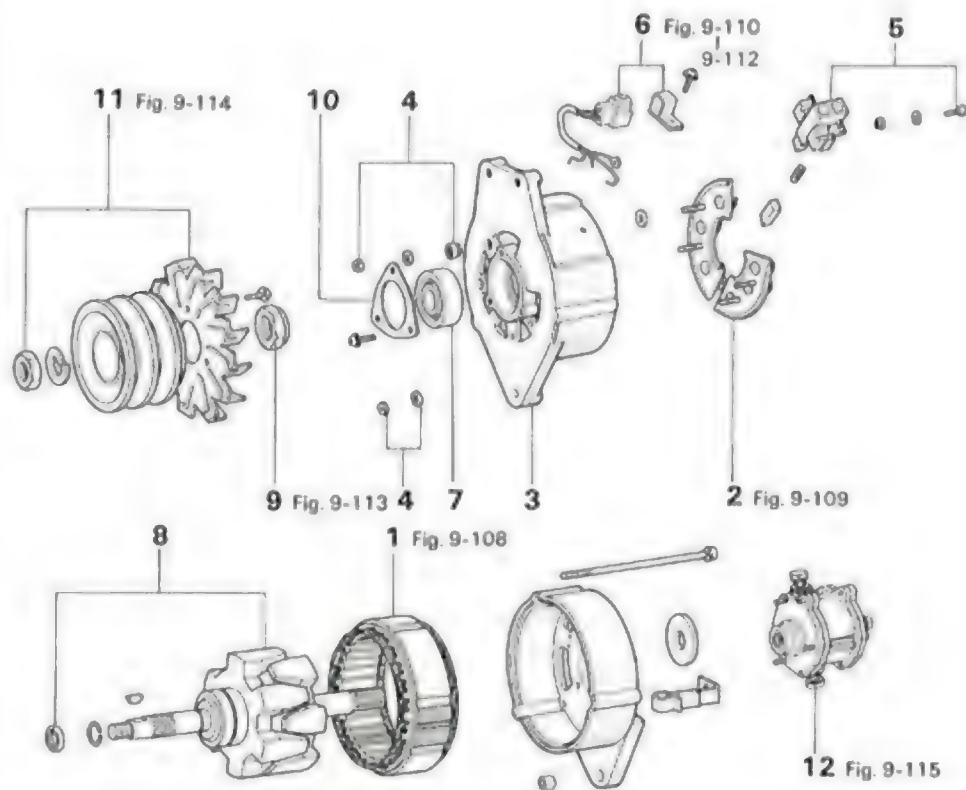


4. Reverse polarity of the test leads and check again.
If there is continuity, the rectifier assembly must be replaced.

ASSEMBLY

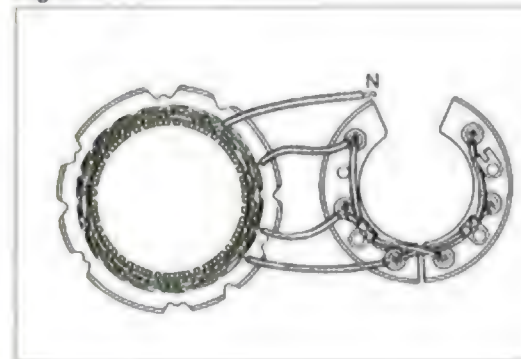
Assemble the parts in the numerical order shown in the figure.

Fig. 9-107



- | | |
|---------------------------------|------------------|
| 1. Stator Coil | 7. Bearing |
| 2. Rectifier Holder & Insulator | 8. Rotor |
| 3. Drive End Frame | 9. Lock Nut |
| 4. Insulator & Nut | 10. Plate |
| 5. Brush Holder | 11. Pulley & Fan |
| 6. Terminal | 12. Vacuum Pump |

Fig. 9-108

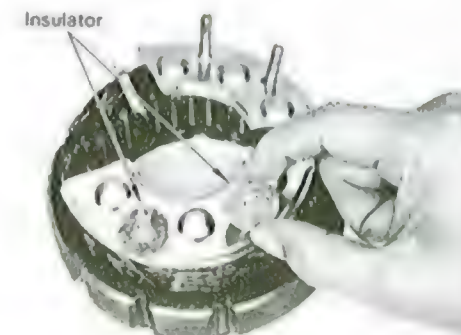


Solder each stator lead to the positive rectifier

— Note —

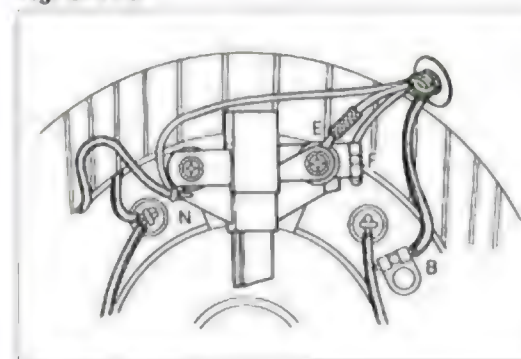
When soldering the leads, hold the rectifier terminal with a long nose pliers to protect the rectifier from heat.

Fig. 9-109



Assemble the rectifier holders and stator coil with insulators onto the rectifier end frame.

Fig. 9-110

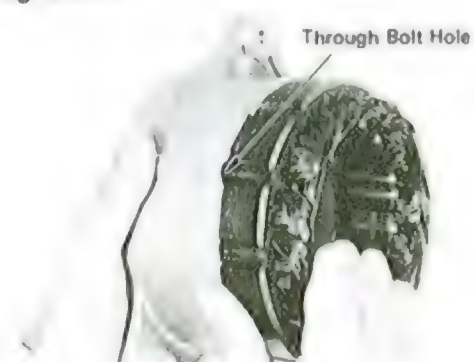


Tie the lead wires and solder terminal F onto the brush holder

Connect terminal E

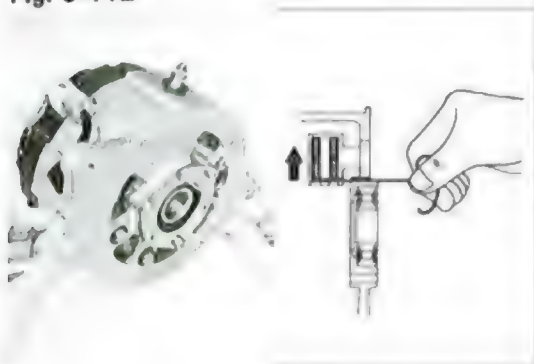
Solder stator coil lead N together with the socket lead N onto the brush holder, and lead B onto the positive rectifier holder.

Fig. 9-111



Align the stator coil notch with the through bolt hole when assembling the stator coil

Fig. 9-112



Push in the brushes and temporarily hold in place with a wire

Fig. 9-113



Secure the rotor shaft in a soft jaw vise and then install the bearing lock nut with SST, SST [09333-55011]

— Note —

1. The bearing lock nut has left-hand threads.
2. Be careful not to damage the stator coil.

Fig. 9-114



Tighten the pulley nut

Tightening torque: 3.5 – 8.0 kg-m
(26 – 57 ft-lb)

Fig. 9-115



Check the rotor for smooth rotation after assembly.

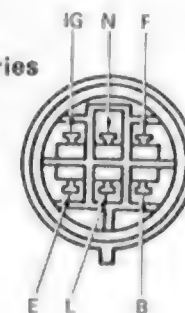
ALTERNATOR REGULATOR

Fig. 9-116

Australia & ECE FJ series



USA
FJ series



FA series

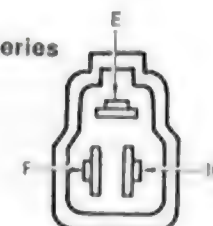


Fig. 9-117



INSPECTION & ADJUSTMENT

Check the connector fitting condition before inspecting the regulator

—Note—

Make sure that the regulator connector is pulled out when inspecting and adjusting.

Fig. 9-118



Inspect each point surface for burns or damage. Replace if defective

Fig. 9-119

**Voltage Adjustment**

1. To adjust, bend the voltage regulator adjusting arm.

Regulated voltage:
13.8 – 14.8 V



Fig. 9-120



2. To adjust the voltage relay, bend the relay adjusting arm.

Relay actuating voltage:
4.0 – 5.8 V



Fig. 9-121

**Resistance Measurement**

- 1 IG – F

Voltage relay	Open	0 Ω
	Closed	Approx. 11 Ω

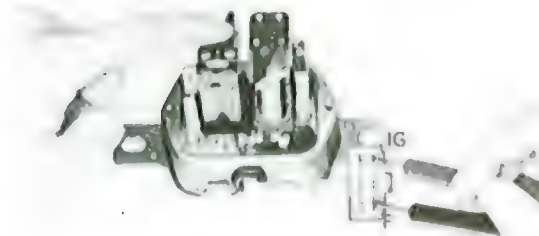


Fig. 9-122



- 2 L – E

Voltage relay	Open	0 Ω
	Closed	Approx. 100 Ω

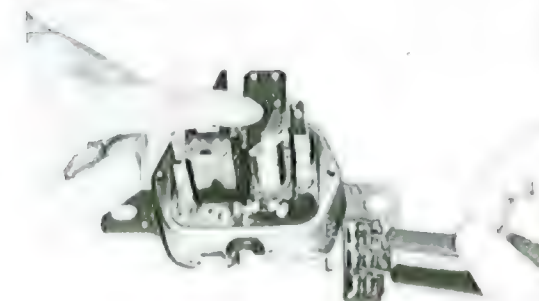


Fig. 9-123



- 3 B – E

Voltage relay	Open	Infinity
	Closed	Approx. 100 Ω



Fig. 9-124



- 4 B – L

Voltage relay	Open	Infinity
	Closed	0 Ω

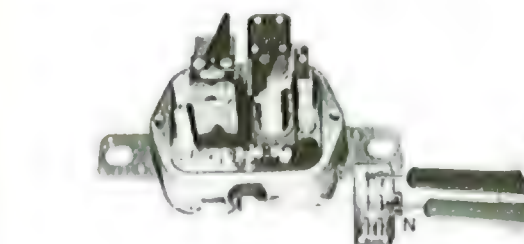


Fig. 9-125



- 5 N – E

Approx. 23 Ω



DISCHARGE WARNING LIGHT RELAY CIRCUIT

Fig. 9-126

FJ 60 series (IC Regulator Type)

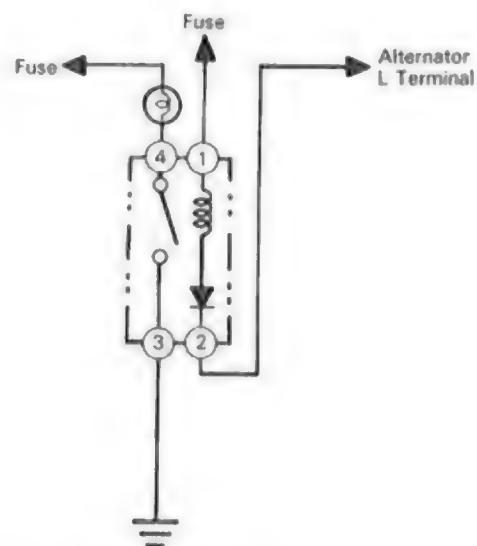
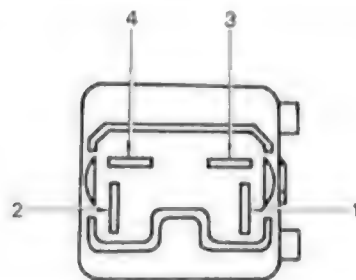


Fig. 9-127



INSPECTION



1. Check that there is no continuity between terminals 3 and 4.
If there is continuity, replace the relay.

Fig. 9-128




2. Connect the \oplus lead from the battery to terminal 1 of the relay and \ominus lead to terminal 2.
Check that there is continuity between terminals 3 and 4.
If there is no continuity, replace the relay.


SST & SERVICE SPECIFICATIONS

	Page
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TIGHTENING TORQUE FOR MAIN PARTS	10-8
SERVICE SPECIFICATIONS	10-9




SST (SPECIAL SERVICE TOOLS)**ENGINE TUNE-UP****Engine Oil**

Illustration	Tool No.	Tool Name
	09228-44010	Oil Filter Wrench

Idle Speed & Idle Mixture Adjustment

Illustration	Tool No.	Tool Name
	09243-00020	Idle Adjust Screw Wrench

ENGINE SERVICE**Cylinder Head**

Illustration	Tool No.	Tool Name
	09201-31010	Valve Stem Oil Seal Replacer
	09201-60011	Valve Stem Guide Remover & Replacer
	09202-43013	Valve Spring Compressor

Timing Gear


Illustration	Tool No.	Tool Name
	09213-60016	Crankshaft Pulley & Gear Puller
	09214-60010	Crankshaft Pulley & Gear Replacer
	09515-35010	Rear Wheel Bearing Replacer

Cylinder Block

Illustration	Tool No.	Tool Name
	09215-00010	Camshaft Bearing Remover & Replacer
	09215-00100	Camshaft Bearing Remover & Replacer
	09223-60010	Crankshaft Rear Oil Seal Replacer
	09303-55010	Input Shaft Front Bearing Puller
	09304-47010	Input Shaft Front Bearing Replacer


LUBRICATION SYSTEM

Oil Pump

Illustration	Tool No.	Tool Name
	09236-00100	Water Pump Overhaul Tool Set

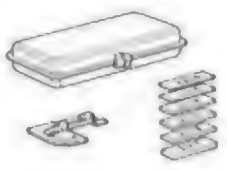
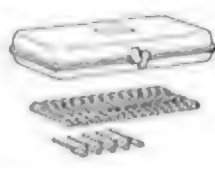
COOLING SYSTEM

Water Pump

Illustration	Tool No.	Tool Name
	09236-00100	Water Pump Overhaul Tool Set

FUEL SYSTEM

Carburetor


Illustration	Tool No.	Tool Name
	09240-00014	Carburetor Adjusting Gauge Set
	09240-00020	Wire Gauge Set

Carburetor (Cont'd)

Illustration	Tool No.	Tool Name
	09243-00020	Idle Adjusting Screw Wrench
	09860-11011	Carburetor Driver Set

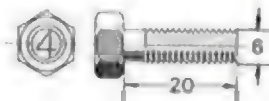
CHARGING SYSTEM

Alternator

Illustration	Tool No.	Tool Name
	09081-00011	Alternator Checker
	09286-46011	Injection Pump Spline Shaft Puller
	09333-55011	Wrench 55 x 32
	09950-20014	Universal Puller

STANDARD BOLT TIGHTENING TORQUE

9 1 1 1 1 - 4 0 6 2 0 ————— Part number
 Length of bolt: 20 mm
 Basic major diameter of thread:
 6 mm
 Bolt head mark*



* Explanation of bolt head marks are as indicated in the following table

SPECIFIED TORQUE FOR STANDARD BOLTS

Class	Basic diameter mm	Pitch mm	Torque limit	kg-m (ft-lb)
4T	6	1	0.4 – 0.7	(3 – 5)
	8	1.25	1.0 – 1.6	(8 – 11)
	10	1.25	1.9 – 3.1	(14 – 22)
	10	1.5	1.8 – 3.0	(14 – 21)
	12	1.25 (ISO)	3.5 – 5.5	(26 – 39)
	12	1.5	3.5 – 5.5	(26 – 39)
	12	1.75	3.0 – 5.0	(22 – 36)
	13	1.5	4.5 – 7.0	(33 – 50)
	14	1.5	5.0 – 8.0	(37 – 57)
	14	2	4.7 – 7.7	(34 – 55)
	16	1.5	7.5 – 11.0	(55 – 79)
	16	2	7.1 – 10.6	(52 – 76)
5T	6	1	0.6 – 0.9	(5 – 6)
	8	1.25	1.5 – 2.2	(11 – 15)
	10	1.25	3.0 – 4.5	(22 – 32)
	10	1.5	2.7 – 4.2	(20 – 30)
	12	1.25 (ISO)	5.0 – 8.0	(37 – 57)
	12	1.5	5.0 – 7.0	(37 – 50)
	12	1.75	4.8 – 6.8	(35 – 49)
	13	1.5	6.5 – 9.0	(48 – 65)
	14	1.5	7.5 – 11.0	(55 – 79)
	14	2	7.0 – 10.5	(51 – 75)
	16	1.5	12.0 – 17.0	(87 – 122)
	16	2	11.5 – 16.5	(84 – 119)
6T	6	1	0.6 – 0.9	(5 – 6)
	8	1.25	1.5 – 2.2	(11 – 15)
	10	1.25	3.0 – 4.5	(22 – 32)
	10	1.5	2.7 – 4.2	(20 – 30)
	12	1.25 (ISO)	5.0 – 8.0	(37 – 57)
	12	1.5	5.0 – 7.0	(37 – 50)
	12	1.75	4.8 – 6.8	(35 – 49)

SPECIFIED TORQUE FOR STANDARD BOLTS (Cont'd)

Class	Basic diameter mm	Pitch mm	Torque limit	kg-m (ft-lb)
7T	6	1	0.8 – 1.2	(6 – 8)
	8	1.25	2.0 – 3.0	(15 – 21)
	10	1.25	4.0 – 5.5	(29 – 39)
	10	1.5	3.7 – 5.2	(27 – 37)
	12	1.25 (ISO)	7.5 – 10.5	(55 – 75)
	12	1.5	7.0 – 9.0	(51 – 65)
	12	1.75	6.0 – 8.5	(44 – 61)
	13	1.5	8.0 – 12.0	(58 – 86)
	14	1.5	10.0 – 15.0	(73 – 108)
	14	2	9.5 – 14.0	(69 – 101)
	16	1.5	15.0 – 23.0	(109 – 166)
	16	2	14.0 – 22.0	(102 – 159)

— Note —

These torque specifications are applicable only for steel (female) threads. They do not apply to other types of material or if the tightening surface is subjected to heat or vibration.

TIGHTENING TORQUE FOR MAIN PARTS

Tightening part	kg-m	ft-lb
Cylinder head x Cylinder block	11.5 — 13.5	84 — 97
Rocker arm support x Cylinder head		
10 mm bolt	3.0 — 4.5	22 — 32
8 mm bolt	2.0 — 3.0	15 — 21
Manifold x Cylinder head	3.9 — 5.1	29 — 36
Camshaft thrust plate x Cylinder block	1.0 — 1.6	8 — 11
Timing gear cover bolt		
6 mm bolt	0.6 — 0.8	53 — 69 in.-lb
10 mm bolt	1.6 — 2.4	12 — 17
Crankshaft pulley x Crankshaft	16.0 — 20.0	116 — 144
Crankshaft bearing cap x Cylinder block		
No.1 — No.3	12.5 — 15.0	91 — 108
No.4	10.5 — 13.0	76 — 94
Piston pin x Connecting rod	5.4 — 7.0	40 — 50
Connecting rod cap x Connecting rod	4.8 — 7.6	35 — 54
Flywheel x Crankshaft	8.0 — 11.0	58 — 79
Oil pan x Cylinder block	0.6 — 1.2	53 — 104 in.-lb

SERVICE SPECIFICATIONS

ENGINE TUNE-UP

Drive belt tension				
(General destinations)				
Deflection with 10 kg (22 lb) force				
Fan — Alternator	N.S.W. & Victoria	13 — 15 mm	0.51 — 0.59 in.	
	Other Australian states ex. Australia	7 — 10 mm	0.28 — 0.39 in.	
Fan — Air Pump	N.S.W. & Victoria	New belt	7 — 9 mm	0.28 — 0.35 in.
		Used belt	9 — 12 mm	0.35 — 0.47 in.
		7 — 10 mm	0.28 — 0.39 in.	
(USA & Canada)				
Borroughs belt tension gauge No. BT-33-73F				
Air con.	New belt	100 — 150 lbs		
	Used belt	60 — 80 lbs		
Others	New Belt	120 — 170 lbs		
	Used belt	80 — 120 lbs		
Battery electrolyte specific gravity				
When fully charged at 20°C (68°F)				
1.25 — 1.27				
Engine oil capacity				
Dry fill		8.0 liters	8.5 US qt	7.0 Imp.qt
	Drain & refill			
	w/ Oil filter change	7.8 liters	8.2 US qt	6.9 Imp.qt
	w/o Oil filter change	7.0 liters	7.4 US qt	6.2 Imp.qt
Radiator cap valve opening pressure				
STD		0.75 — 1.05 kg/cm ²	10.7 — 14.9 psi	
	Limit	0.6 kg/cm ²	8.5 psi	
Coolant capacity w/ Heater or Air con.				
FJ40, 43, 45 series		16.0 liters	16.9 US qt	14.1 Imp.qt
	FJ60 series	16.5 liters	17.4 US qt	14.5 Imp.qt
	FA series	25.0 liters	26.4 US qt	22.0 Imp.qt
Spark plugs				
Type	FJ series	ND	W14EXR-U (USA & ECE)	
			W14EX-U (Others)	
		NGK	BPR4EY (USA & ECE)	
			BP4EY (Others)	
	FA series	ND	W14EX-U	
			BP4EY	
Gap			0.8 mm	0.031 in.
			Less than 25 kΩ per cord	
High tension cord resistance				
Distributor				
Air gap (USA FJ series)		0.2 — 0.4 mm	0.008 — 0.016 in.	
	Rubbing block gap (Others)	0.30 mm	0.0118 in.	

ENGINE TUNE-UP (Cont'd)

Ignition timing				
Dwell angle (except USA FJ series)			41°	
Ignition timing			7° BTDC/ Max. 950 rpm	
Firing order			1 - 5 - 3 - 6 - 2 - 4	
Valve clearance	Hot	Intake	0.20 mm	0.008 in.
		Exhaust	0.35 mm	0.014 in.
Idle speed			650 rpm	
Idle mixture speed	(except USA)		690 rpm	
Fast idle speed	USA		1,800 rpm (w/ EGR & EVAP systems OFF and vacuum advancer OFF)	
	N.S.W. & Victoria		1,800 rpm (w/ EGR & EVAP systems OFF)	
	Others		1,800 rpm	
Throttle positioner setting speed				
	N.S.W. & Victoria		1,200 rpm (w/ EGR & EVAP systems OFF)	
	Others		1,000 rpm	
Compression pressure	at 250 rpm			
		STD	10.5 kg/cm ²	149 psi
		Limit	8.0 kg/cm ²	114 psi
Pressure difference between each cylinder			Less than 1.0 kg/cm ² (14 psi)	

ENGINE

Cylinder Head

Head surface warpage		Limit	0.15 mm 0.0059 in.
Manifold mounting surface warpage		Limit	0.10 mm 0.0039 in.
Maximum reface		Limit	0.20 mm 0.0079 in.
Valve seat	Refacing angle	30°, 45°, 65°	
	Contacting angle	45°	
	Contacting width	Intake	1.4 mm 0.055 in.
		Exhaust	1.7 mm 0.067 in.

Valve & Guide Bushing

Valve				
Overall length	Limit	Intake	124.8 mm	4.913 in.
		Exhaust	125.0 mm	4.921 in.
Valve face angle		IN & EX	45.5°	

Valve & Guide Bushing (Cont'd)

Stem diameter		Intake	7.970 – 7.985 mm	0.3138 – 0.3144 in.
		Exhaust	7.960 – 7.975 mm	0.3134 – 0.3140 in.
Stem end refacing	Limit	IN & EX	0.5 mm	0.020 in.
Stem oil clearance	STD	Intake	0.03 – 0.06 mm	0.0012 – 0.0024 in.
		Exhaust	0.04 – 0.07 mm	0.0016 – 0.0028 in.
	Limit	Intake	0.10 mm	0.0039 in.
		Exhaust	0.12 mm	0.0047 in.
Head edge thickness	Limit	Intake	0.8 mm	0.031 in.
		Exhaust	1.0 mm	0.039 in.
Guide bushing				
Inner diameter		IN & EX	8.01 – 8.03 mm	0.3154 – 0.3161 in.
Outer diameter		STD	14.028 – 14.041 mm	0.5523 – 0.5528 in.
		O/S type 0.05	14.078 – 14.091 mm	0.5543 – 0.5548 in.
Protrusion from cylinder head			17.5 mm	0.689 in.
Replacing temperature (Cylinder head side)			Normal temperature	

Valve Rocker Arm & Shaft

Shaft to arm oil clearance	STD	0.018 - 0.043 mm 0.0007 - 0.0017 in.
	Limit	0.08 mm 0.0031 in.

Valve Spring

Free length		51.5 mm 2.028 in.
Installed length		43.0 mm 1.693 in.
Installed load	STD	32.5 kg 71.6 lbs
	Limit	27 kg 59.5 lbs
Squareness	Limit	1.8 mm 0.071 in.

Camshaft

Thrust clearance	STD	0.200 – 0.262 mm	0.0079 – 0.0103 in.	
	Limit	0.3 mm	0.012 in.	
Journal oil clearance	STD	0.025 – 0.075 mm	0.0010 – 0.0030 in.	
	Limit	0.1 mm	0.0039 in.	
Journal diameter	STD	No.1	47.955 – 47.975 mm	1.8880 – 1.8888 in.
		No.2	46.455 – 46.475 mm	1.8289 – 1.8297 in.
		No.3	44.955 – 44.975 mm	1.7699 – 1.7707 in.
		No.4	43.455 – 43.475 mm	1.7108 – 1.7116 in.
	Bearing U/S type		0.25, 0.50	
Circle runout	Limit	0.15 mm	0.0059 in.	
Cam height	Limit	Intake	38.0 mm	1.496 in.
		Exhaust	37.9 mm	1.492 in.

Valve Lifter

Oil clearance	STD	0.019 – 0.075 mm	0.0007 – 0.0030 in.
	Limit	0.1 mm	0.004 in.
Outer diameter	STD	25.15 mm	0.9902 in.
	O/S type 0.05	25.20 mm	0.9921 in.

Timing Gear

Backlash	STD	0.05 – 0.12 mm	0.0020 – 0.0047 in.
	Limit	0.2 mm	0.008 in.

Manifold

Installing surface warpage	Limit	0.5 mm	0.020 in.
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Cylinder Block

Warping	Limit	0.15 mm	0.0059 in.
Cylinder bore	STD	94.00 – 94.05 mm	3.7008 – 3.7027 in.
Cylinder bore wear	Limit	0.2 mm	0.008 in.
Difference of bore limit between cylinder		Less than 0.05 mm (0.0020 in.)	
Taper and out-of-round	Limit	0.02 mm	0.0008 in.

Piston & Piston Ring

Piston diameter	STD	93.96 – 94.01 mm	3.6992 – 3.7012 in.
	O/S type 0.50	94.46 – 94.51 mm	3.7189 – 3.7209 in.
	O/S type 1.00	94.96 – 95.01 mm	3.7386 – 3.7405 in.
	O/S type 1.50	95.46 – 95.51 mm	3.7583 – 3.7602 in.
		0.03 – 0.05 mm	0.0012 – 0.0020 in.
Piston to cylinder clearance			
Piston ring end gap (compression)	No.1	0.20 – 0.56 mm	0.0079 – 0.0220 in.
	No.2	0.20 – 0.58 mm	0.0079 – 0.0228 in.
	Oil	0.20 – 0.88 mm	0.0079 – 0.0346 in.
	NP	0.20 – 0.58 mm	0.0079 – 0.0228 in.
	Riken	0.20 – 0.58 mm	0.0079 – 0.0228 in.
Ring to ring groove clearance	No.1	0.03 – 0.07 mm	0.0012 – 0.0028 in.
	No.2	0.02 – 0.06 mm	0.0008 – 0.0024 in.
	Oil	0.03 – 0.07 mm	0.0012 – 0.0028 in.
	N.S.W.	0.04 – 0.19 mm	0.0016 – 0.0075 in.
	Others	0.04 – 0.19 mm	0.0016 – 0.0075 in.
Piston pin to piston oil clearance		0.008 – 0.012 mm	0.0003 – 0.0005 in.

Connecting Rod & Bearing

Thrust clearance	STD	0.08 – 0.24 mm	0.0031 – 0.0094 in.
	Limit	0.3 mm	0.012 in.
Bearing oil clearance	STD	0.02 – 0.06 mm	0.0008 – 0.0024 in.
	Limit	0.1 mm	0.004 in.
Bearing type	STD	Bearing U/S type	0.05, 0.25, 0.50
Bend	Limit	per 100 mm (3.94 in.)	0.05 mm
Twist	Limit	per 100 mm (3.94 in.)	0.15 mm

Crankshaft

Thrust clearance	STD	0.06 – 0.16 mm	0.0024 – 0.0063 in.
	Limit	0.3 mm	0.012 in.
Main journal oil clearance	STD	0.020 – 0.044 mm	0.0008 – 0.0017 in.
	Limit	0.10 mm	0.0039 in.
Main journal diameter	STD	No.1	66.972 – 66.996 mm
		No.2	68.472 – 68.496 mm
		No.3	69.972 – 69.996 mm
		No.4	71.472 – 71.496 mm
	Bearing U/S type		0.05, 0.25, 0.50
Crank pin diameter	STD	53.98 – 54.00 mm	2.1252 – 2.1260 in.
Circle runout	Limit	0.1 mm	0.004 in.
Main journal taper and out-of-round	Limit	0.01 mm	0.0004 in.
Crank pin journal taper and out-of-round	Limit	0.01 mm	0.0004 in.

Flywheel

Runout	Limit	0.1 mm	0.004 in.
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LUBRICATION SYSTEM**Oil Pump**

Tip clearance	STD	0.11 – 0.18 mm	0.0043 – 0.0071 in.
	Limit	0.2 mm	0.008 in.
Side clearance	STD	0.03 – 0.09 mm	0.0012 – 0.0035 in.
	Limit	0.15 mm	0.0059 in.
Gear backlash	STD	0.5 – 0.6 mm	0.020 – 0.024 in.
	Limit	0.95 mm	0.0374 in.
Cover wear	Limit	0.15 mm	0.0059 in.

COOLING SYSTEM**Water Pump**

Bearing installing temperature	80°C	176°F
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Radiator

Radiator cap relief valve opening pressure	STD	0.75 – 1.05 kg/cm ²	10.7 – 14.9 psi
	Limit	0.6 kg/cm ²	8.5 psi

Thermostat

Valve opening temperature	Starts to open at	86 – 90°C	187 – 194°F
	Fully opens at	100°C	212°F
Valve opening travel		10 mm	0.39 in.

Ignition Coil

Primary coil resistance		
	USA FJ series	0.5 – 0.7 Ω
	FA & General FJ series	1.2 – 1.5 Ω
	ECE & Australia FJ series	1.3 – 1.6 Ω
Secondary coil resistance		
	USA FJ series	11.5 – 15.5 k Ω
	FA & General FJ series	8.5 – 11.5 k Ω
	ECE & Australia FJ series	10.7 – 14.5 k Ω
External resistor resistance		1.3 – 1.5 Ω

High Tension Cord

Resistance	Limit	Less than 25 k Ω per cord
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Spark Plugs

Type	FJ series	ND	W14 EXR-U (USA & ECE)
		NGK	W14 EX-U (Others)
	FA series	ND	BPR4EY (USA & ECE)
		NGK	BP4EY (Others)
Gap			W14EX-U
			BP-4EY
			0.8 mm
			0.031 in.

CHARGING SYSTEM**Alternator**

Alternator type		w/o IC Regulator	w/ IC Regulator
Rated output		40A, 45A, 50A	55A
Brush exposed length	STD	12.5 mm (0.492 in.)	—
	Limit	5.5 mm (0.217 in.)	—
Rotor coil resistance		3.9 – 4.1 Ω	2.8 – 3.0 Ω

Alternator Regulator

Regulating voltage	Tirrill type	13.8 – 14.8 V (40A, 45A, 50A)
	IC regulator	14.0 – 14.7 V (55A)
Voltage relay actuating voltage	Tirrill type	4.0 – 5.8 V



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